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ON

ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION USING TISSUE DOPPLER IMAGING BEFORE AND AFTER PTCA OF LEFT ANTERIOR DESCENDING CORONARY ARTERY

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CERTIFICATE

This is to certify that this dissertation entitled "**ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION USING TISSUE DOPPLER IMAGING BEFORE AND AFTER PTCA OF LEFT ANTERIOR DESCENDING CORONARY ARTERY "** is the bonafide record work done by **Dr . K. KALYANARAMAN,** submitted as partial fulfillment for the requirements of **D.M.Degree Examinations Branch II Cardiology** to be held in **August 2013**.

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INTRODUCTION

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Regional wall motion abnormalities are frequently seen in coronary artery disease and diastolic function is impaired before systolic dysfunction in these patients[1]. Reperfusion with percutaneous coronary intervention has been shown to improve the left ventricular systolic and diastolic function [2, 3].

Changes in the regional ventricular function may appear before alteration of global ventricular function in coronary artery disease [3].

The most recent approach to analysis of regional wall motion is with Doppler tissue imaging or Speckle tissue tracking[4].

Systolic and diastolic velocities of myocardium in cardiac cycle can be recorded quantitatively by Tissue Doppler Imaging and thereby provides a newer way of assessing left ventricular function which is more sensitive than traditional methods[5].

Tissue Doppler imaging has a high sensitivity, high feasibility, reproducibility and ease of application in acute coronary syndrome[6].

Tissue Doppler imaging is easily available in most of the centres. Tissue Doppler parameters such as Sm(peak systolic velocity), Em(early diastolic velocity) and Am(late diastolic velocity) are powerful predictors of cardiac mortality[7].

We wanted to study the changes in Tissue Doppler Imaging parameters before and after percutaneous coronary angioplasty as an easily available tool in Indian scenario to assess the functional improvement in left ventricular function.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

J.M.Strotmann et al studied the effect of myocardial ischemia on longitudinal myocardial function in thirty patients before and after Percutaneous Transluminal Coronary Angioplasty of single vessel disease. Peak systolic velocity increased in the ischemic segments after Percutaneous Transluminal Coronary Angioplasty[3].

Derumeaux et al have shown clear relationship between regional myocardial velocity and myocardial perfusion in animal models[8].

Klisiewicz A et al effect of angioplasty in 39 patients 1 to 6 months after myocardial infarction. Peak systolic velocity increased and contractile reserve increased after angioplasty. Regional Em wave velocity increased 24 hours after angioplasty, but there was no increase in Am wave velocity 24 hours after angioplasty[9].

Park SM et al studied 20 patients with anterior wall myocardial infarction using Doppler tissue imaging as a tool to predict myocardial viability. They showed Strain rate imaging was a better predictor to show viable myocardium after Percutaneous Coronary Angioplasty[10].

Minamihaba O et al compared Pulse Doppler Tissue Imaging with 99mTc sestamibi perfusion imaging in 30 patients before and after

coronary angioplasty. The peak systolic velocity was positively correlating with Tc-MIBI uptake(R=0.59,p <0.01).

The PEP/ET(preejection period/ejection time) and peak systolic velocity is having higher diagnostic accuracy for detecting viable myocardium when compared with Tc-MIBI perfusion imaging(79% and 80% vs 90%)[11].

Tumuklu M et al studied improvement in diastolic function after Percutaneous Coronary Angioplasty in 31 patients. They showed a significant increase in diastolic parameters of left ventricle i.e. Sm, increased from 11.3 ± 3.1 cm/sec to 13.2 ± 3.6 cm/sec p = 0.03;isovolumetric relaxation time(IVRT) decreased from 130 ± 37 msec to 108 ± 29 msec p = 0.0001;IVCT(isovolumetric contraction time decreased from 84.1 ± 19.2 msec to 75.6 ± 12.2 msec.[12]

Hasan Shemirani et al evaluated early alterations in tissue doppler findings of the septal and lateral segments of left ventricle after coronary angioplasty in forty patients with single vessel disease. Em and Am velocity significantly improved in septum and Sm velocity does increased, but not statistically significant. This study showed diastolic function improved immediately after coronary angioplasty but not the systolic function.[13]

Penicka M et al analyzed 43 patients with myocardial infarction and single vessel disease. They used positive pre ejection velocity to predict recovery of left ventricle contractile function. Their study showed positive pre ejection velocity measured by tissue myocardial velocity can predict recovery of ischemic myocardium.[14]

Myocardial perfusion imaging, Magnetic resonance imaging is the best clinical tools to assess the myocardial viability after angioplasty. They are expensive and not available in all centres.

Tissue Doppler imaging is quick quantitative method to assess the functional recovery of myocardium after Coronary Angioplasty.

Doppler Tissue Imaging

Doppler tissue imaging can be performed by using pulse tissue Doppler imaging, color 2D Doppler and color M mode Doppler. Tissue Doppler imaging can be used as a noninvasive tool to assess the systolic and diastolic myocardial function.[15]

Doppler Effect

The Doppler Effect is the phenomenon whereby the frequency of a reflected wave is altered by movement of reflecting surface away from or toward the source. The low Doppler shift frequencies of high energy

generated by the wall motion are filtered out. These low Doppler shift frequencies are produced by myocardium; hence their assessment is useful to know the ventricular function.[16]

Pulse Doppler technique can be used to obtain high quality Doppler signals, measuring mean and instantaneous local acceleration, rapid quantification.

The limitations of pulse TDI are

1. The need for manual mapping

2. Limited spatial resolution

3. Simultaneous recording of different segments is not possible.

The longitudinal and circumferential fibers of ventricle contribute to overall function of left ventricle. Tissue Doppler imaging is influenced by overall cardiac movement and tethering by adjacent myocardial tissues.[17]

The normal velocity of Em for lateral annulus is more than 15 cm/sec and septal annulus is above 10 cm/sec.This difference in velocity between lateral and septal annulus is due to different orientation of myocardial fibres.Tissue Doppler velocity is more at the base of ventricle than at mid ventricle and apex.[18]

Em velocity indicates myocardial relaxation. Em is low and does not increase in patients with impaired myocardial relaxation. Em is the earliest marker of diastolic dysfunction and is less in all stages of diastolic dysfunction.[18]

Normally Em/Am ratio is more than one .In grade I diastolic dysfunction Em is less than Am. Em and Am velocity progressively decreases from grade II to grade III diastolic dysfunction.[18]

Normal values of TDI

In children and young adults lateral annulus velocity is more than 20 cm/sec.

Lateral annulus velocity more than 12 cm/sec in adults above 30 years denotes normal left ventricle diastolic function.

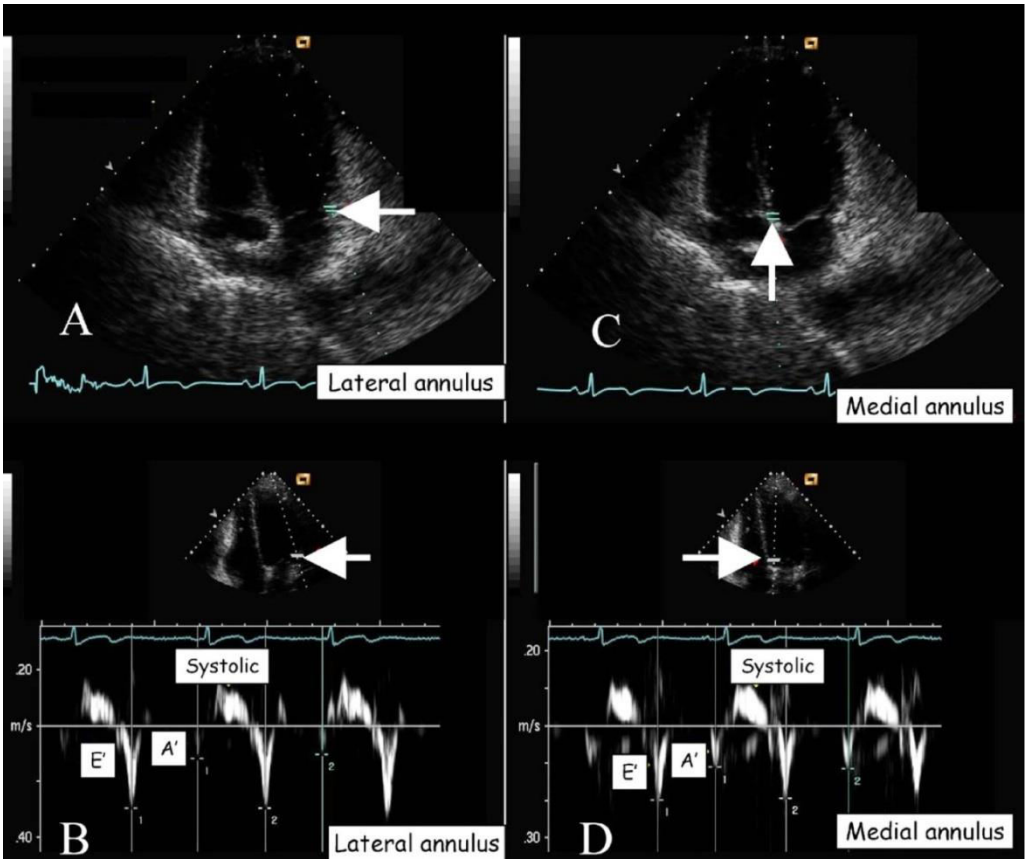
Table A showing normal values in general population[19]

TDI	Septum	Lateral	Inferior	Anterior
S wave, cm				
Basal	5.97 ± 1.14	6.26 ± 2.44	6.52± 1.31	6.44± 2.32
Mid	6.29 ± 1.89	4.48± 0.92	5.21± 2.79	5.1 ± 1.16
Apical	4.42 ± 2.3	4.81 ± 1.97	2.97± 1.14	3.8 ± 2.66
E wave, cm				
Basal	7.91± 2.16	8.54± 2.77	9.01± 2.44	8.09± 2.48
Mid	8.39 ± 2.5	6.85± 1.86	6.82± 3.16	7.22± 2.04
Apical	6.03 ± 2.95	6.74± 2.58	4.76 ± 1.94	4.52± 2.95
A wave, cm				
Basal	5.99 ± 1.73	3.77 ± 1.95	5.84± 2.06	3.86 ± 1.75
Mid	4.87± 2.14	4.9 ± 1.72	2.62± 1.84	4.78 ± 1.7
Apical	2.69± 1.93	3.77 ± 2.1	3.08 ± 1.54	1.69± 1.45

Tissue Doppler image

Figure 1

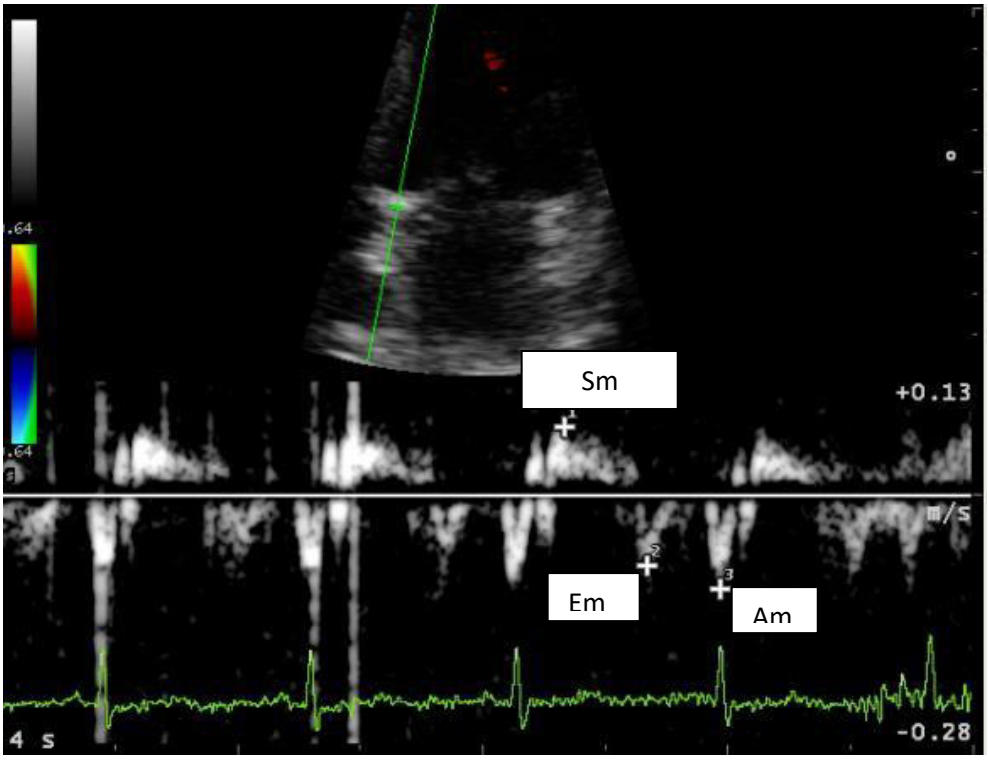
TDI at basal lateral wall of Left Ventricle and basal septal wall of Left Ventricle



TDI indicates tissue Doppler imaging

Figure 2

Tissue Doppler imaging of basal septum of left ventricle



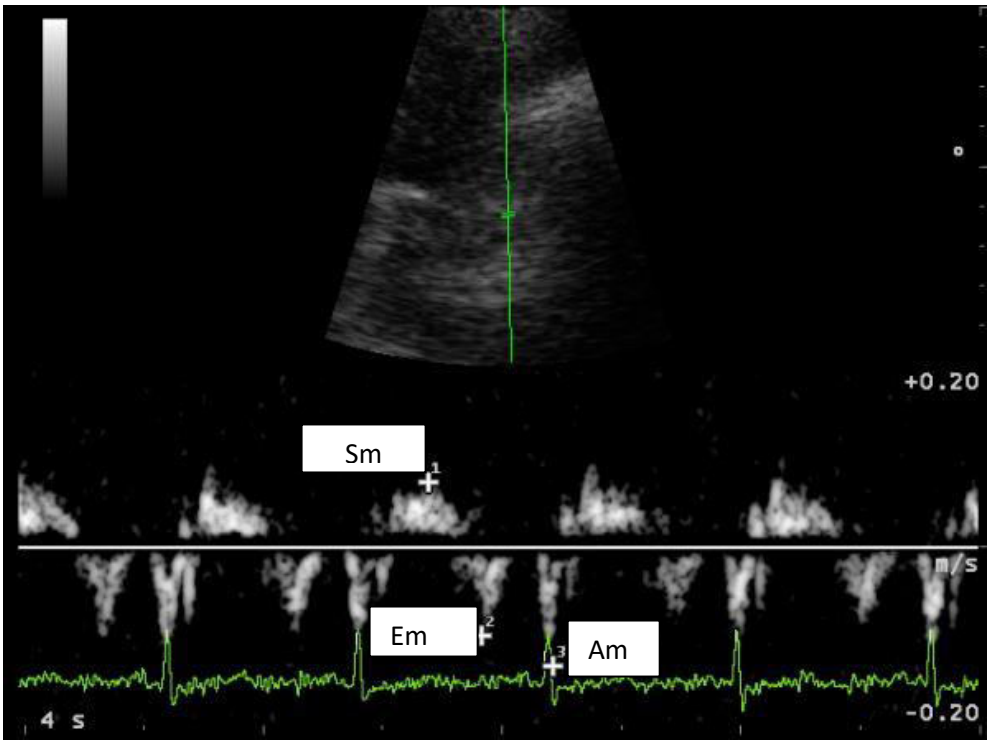
Sm - peak systolic velocity.

Em - early diastolic velocity.

Am - late diastolic velocity.

Figure 3

Tissue Doppler imaging of basal lateral wall of left ventricle



Sm - peak systolic velocity.

Em - early diastolic velocity.

Am - late diastolic velocity.

Uses of Doppler tissue imaging

Global left ventricular systolic function

We can quantify the movement of cardiac basal septum and basal lateral wall of left ventricle using M mode echocardiography.Quatification of movement of basal segments of ventricle can also be done using Tissue Doppler echocardiography.

Gulati et al showed that six site peak annular descent velocity correlated linearly with radionuclide ejection fraction(r = 0.86, SEE = 1.02cm/sec).[20]

Peak systolic velocity was less in dilated cardiomyopathy.Doppler Tissue Imaging peak systolic velocity correlated with angiographically calculated Ejection Fraction and peak dp/dt.[21]

Regional systolic function of ventricles

Regional myocardial velocity varies among individual segments of ventricle in normal patients.

Systolic myocardial velocity is normally high at base of ventricles than at the mid wall and apex. Systolic myocardial velocity of Lateral tricuspid annulus is more than the lateral mitral annulus velocity. Tissue

Doppler imaging is useful to detect regional changes in myocardial contractility.[22]

Lateral annulus Systolic myocardial velocity is used to see the longitudinal left ventricle systolic function and there is linear relationship with left ventricle ejection fraction and left ventricle dp/dt.

Before and after angioplasty

Based on some studies myocardial systolic velocity was less in ischemic and infracted segments of left ventricle. With inflation of coronary balloon in coronary artery ,peak myocardial velocity decreases with rebound increase after deflation of balloon and reperfusion.[23]

Changes in systolic myocardial velocity depend on the ischemic severity and there is a relation between myocardial velocity and coronary perfusion.

Normalization of peak systolic velocity with dobutamine stress echocardiogram and exercise is a marker of viable myocardium.[24]

Assessment of diastolic function by Doppler tissue imaging

Mitral inflow Doppler is preload dependant and its use to assess the diastolic dysfunction of left ventricle is limited.[25]

In patients with diastolic dysfunction Em velocity and Em/Am ratio was low when compared with normal individuals. Coronary artery disease patients with normal systolic function have abnormal diastolic function of left ventricle.[26]

Active relaxation of left ventricle

Early diastolic myocardial velocity indicates myocardial relaxation.Pre load has less effect on measuring early diastolic velocity.

Myocardial time constant of isovolumic relaxation Tau was linearly related to early diastolic velocity and Em/Am ratio.[27]

AIM OF THE STUDY

AIM OF THE STUDY

1. To evaluate the Regional Myocardial Function using Tissue Doppler Imaging before and after Percutaneous Transluminal Coronary Angioplasty.

2. To assess the extent to which these tissue Doppler indices change 24 hours before Percutaneous Transluminal Coronary Angioplasty, 24 hours after Percutaneous Transluminal Coronary Angioplasty and 3 months after Percutaneous Transcutaneous Coronary Angioplasty.

3. To evaluate how this helps to know the success of Percutaneous Transluminal Coronary angioplasty.

MATERIAL AND METHODS

MATERIALS AND METHODS

This prospective non randomized follow up study was carried out at Rajiv Gandhi Government General Hospital, Chennai.This study was done between march 2012 to January 2013.This study was approved by our institution ethical committee.

SELECTION OF STUDY SUBJECTS

INCLUSION CRITERIA

1. All patients with Stable angina and prior Myocardial Infarction with age above 30 years and both sex.

2. Patients with prior coronary angiogram showing isolated Left anterior descending coronary artery disease suitable for elective percutaneous intervention and stenting were included.

EXCLUSION CRITERIA

Patients with any of the following criteria were excluded from the study

1. Patients with Non ST Elevation Myocardial Infarction, Unstable angina, Acute ST Elevation Myocardial Infraction

2. Patients with multivessel coronary artery disease, left circumflex coronary artery disease, right coronary artery disease

3. Patients with valvular heart disease, cardiomyopathy, atrial fibrillation, prior coronary revascularization, congenital heart disease, moderate to severe left ventricular systolic dysfunction (Ejection Fraction less than 40%).

STUDY PROTOCOL

Written informed consent was obtained from all the patients and this study was approved by our hospital ethical committee. Patients with recent myocardial infarction with prior coronary angiogram showing isolated single vessel disease of Left Anterior Descending Coronary artery admitted for Percutaneous Transluminal Coronary Angioplasty with Bare Metal Stent were selected. Patients belonged to both sex and above 30 years. History and physical examination was done for all patients in this study. All routine laboratory investigation was done. Patients were examined with echocardiogram 24 hours before Percutaneous Transluminal Coronary Angioplasty; 24 hours after Percutaneous Transluminal Coronary Angioplasty and 3 months after Percutaneous Transluminal Coronary Angioplasty.

ECHOCARDIOGRAPHY

Routine Echocardiographic evaluation and Tissue Doppler imaging was done for all the selected 93 patients 24 hours before PTCA,24 hours after PTCA and 3 months after PTCA.Philips XD7 with adult transducer and Esaote mylab 25 was used to acquire images using tissue Doppler imaging software.

Echocardiographic examination is done as per recommendations of the American Society of Echocardiography. Left ventricular ejection Fraction was calculated using simplified quinones method.

TISSUE DOPPLER IMAGING

Tissue Doppler imaging of medial basal septum and basal lateral wall of Left Ventricle was performed in apical 4 chamber view within 1 cm of mitral leaflets .Using Tissue Doppler imaging software preset ,three major myocardial velocities were recorded with angulation less than 20 degrees. Recording is done at sweep speed of 50 to 100 mm/sec at end expiration.[28] Average Peak myocardial systolic(Sm wave), peak myocardial early diastolic velocity (Em wave) and peak myocardial late diastolic velocities (Am wave) of 3 values were recorded 24 hours before Percutaneous Transluminal Coronary Angioplasty; 24 hours after Percutaneous Transluminal Coronary Angioplasty and 3 months after Percutaneous Transluminal Coronary Angioplasty.

PERCUTANEOUS CORONARY INTERVENTION

Percutaneous Transluminal Coronary Angioplasty of proximal or mid Left Anterior Descending coronary artery with Bare Metal Stenting was

done using Toshiba fixed catheterization laboratory according to standard techniques. All patients had successful Percutaneous Transluminal Coronary angioplasty results with residual stenosis less than 30 %.None of the patients had any peri procedural myocardial infarction or complications. All patients were discharged after 3-5 days with dual antiplatelets, Angiotensin Converting Enzyme inhibitors, beta blockers and statins.They were on follow up every 15 days for drugs and repeat evaluation with echocardiogram was done after 3 months. Follow up Coronary Angiogram was not done at 3 months.

STATISTICAL ANALYSIS

Statistical analysis was done using online paired two tailed t test. A two tailed p value of less than 0.05 was required for significance.

RESULTS

RESULTS

RESULTS AND OBSERVATION

AGE AND SEX DISTRIBUTION

Table 1

Age / sex	30 – 40	41 – 50	51 – 60	61 – 70	Total
Male	12	33	30	10	85(91.3)
Female	1	3	2	2	8(8.6)
Total	13(13.9)	36(38.7)	32(34.4)	12(12.9)	93

91.3% of patients in were males and 8.6% of patients were females in this study.

A youngest patient was 30 years old and the oldest patient age was 70.

73 males were above the age of 40 years and 7 females were above the age of 40 years.12 males and 1 female were less than 40 years old.

13.9% belong to the age group of 30-40 years;38.7% were in the age group of 41-50 years;

34.4% were in the age group of 51-60 years;12.9% were in the age group of 61-70 years.

73% of patients were in the age group of 41-60 years.

Mean age of patients in this study was 50.08 ± 18.04 years.

ASSESSMENT OF RISK FACTORS

TABLE NO 2

RISK FACTORS	MALE	FEMALE
Smoker	68	0
Diabetes mellitus	67	8
Hypertension	20	1
Diabetes mellitus, Hypertension and Smoker	8	0
Diabetes Mellitus and Smoker	35	0
Hypertension and Smoker	2	0

68 male patients were smokers in our study.67 males and 8 females patients have Diabetes Mellitus as risk factor.

20 male and 1 female patient have Hypertension as coronary risk factor.

8 male patients had all the three risk factors that is Smoking, Diabetes Mellitus and Hypertension.

35 male patients had two risk factors i.e. Diabetes mellitus and Smoking.

2 male patients had Hypertension and Smoking as risk factor for atherosclerosis.

Majority of the patients were smokers and having Diabetes Mellitus.

None of the female patient has more than one risk factor.There was no smokers in female patients.

OTHER BASELINE CHARECTERISTICS OF ALL PATIENTS IN OUR STUDY

Table 3

Parameters	Range	Mean ± sd
Age	30-70 years	50.08 ± 18.04 years
Male –no (%)	85(91.39%)	
Heart rate	50 – 94 beats per min	71.2 ± 20.92 beats per min
Systolic BP	110 – 160 mm of Hg	128 ± 25.78 mm of Hg
Diastolic BP	80 – 90 mm of Hg	80.36 ± 3.15 mm of Hg
Random blood glucose	79 – 206 mg/dl	126.22 ± 58.98 mg/dl
Blood urea	20 – 38 mg/dl	27.66 ± 6.64 mg/dl
Serum creatinine	0.4 – 1.1 mg/dl	0.81 ± 0.19 mg/dl
Bare metal stent diameter	2.5 – 3.5 mm	2.95 ± 0.54 mm
Bare metal stent length	12 – 30 mm	21 ± 9.2 mm

sd denotes Standard deviation,mg/dl denotes milligrams/deciliter and mm denotes millimeter.

The average heart rate in this study was 71.2 ± 20.92 beats per min.

The average systolic blood pressure was 128 ± 25.78 mm of Hg and the average diastolic blood pressure was 80.36 ± 3.15 mm of Hg.

The minimum heart rate was 50 beats per minute and the maximum heart rate was 94 beats per minute.

The random blood glucose was 126.22 ± 58.98mg/dl.The lowest random blood glucose was 79 mg/dl and highest random blood glucose was 206 mg/dl

The average blood urea and serum creatinine was 27.66 ± 6.64 mg/dl and 0.81 ± 0.19 mg/dl respectively.

The average diameter and length of the bare metal stent used in this study were 2.95 ± 0.54 mm and 21 ± 9.2 mm respectively.The minimum stent diameter used was 2.5 mm and the maximum stent diameter used was 3.5 mm.The minimum stent length used was 12 mm and the maximum stent length used was 30 mm.

Table 4

Sm velocity of basal medial septum 24 hours before PTCA, 24 hours after PTCA, 3 months after PTCA

	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Sm(cm/sec)	8.498	0.421	0.044	9.068	0.424	0.044	8.992	0.431	0.045
Two tailed p value	P <0.0001 Statistically significant						P <0.0001 Statistically significant		
95% CI	-0.636 to – 0.504						0.042 to 0.108		

SD denotes standard deviation; SEM denoted standard error of mean.Sm peak systolic velocity.CI denotes confidence interval.PTCA denotes percutaneous transluminal coronary angioplasty.p denote probability.

The mean Sm velocity of basal medial septum increased from 8.498cm/sec 24 hours before Percutaneous Transluminal Coronary Angioplasty to 9.068cm/sec 24 hours after Percutaneous Transluminal Coronary Angioplasty .

The mean Sm velocity of basal medial septum was 8.992cm/sec at three months after Percutaneous Transluminal Coronary Angioplasty.

P value was less than 0.0001 when comparing 24 hours before and 24 hours after Percutaneous Transluminal Coronary Angioplasty. This is extremely significant.

Similarly p value for Sm velocity of basal medial septum was less than 0.0001 at 3 months post Percutaneous Transluminal Coronary Angioplasty which is significant.

This shows the fact that systolic function of basal medial septum increases definitively after Percutaneous Transluminal Coronary Angioplasty.

Table 5

Em velocity of basal medial septum 24 hours before PTCA,24 hours after PTCA,3 months after PTCA

	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Em (cm/sec)	5.141	0.679	0.070	5.09	0.684	0.071	5.0162	0.6968	0.072
Two tailed p value	P =0.0902 Not significant						P <0.0001 significant		
95% CI	-0.008 to 0.109						0.0445 to 0.1036		

SD means standard deviation; SEM means standard error of mean; CI denotes confidence interval.Em early diastolic velocity.PTCA denotes percutaneous transluminal coronary angioplasty

The mean Em velocity of basal medial septum 24 hours before and 24 hours after Percutaneous Transluminal Coronary Angioplasty was similar i.e.5.141 vs 5.09 cm/sec.

When computing p value at 24 hours after Percutaneous Transluminal Coronary Angioplasty the change in mean Em velocity of basal medial septum was not statistically significant i.e. p value was less than 0.09

The mean Em velocity of basal medial septum 3 months after Percutaneous Transluminal Coronary Angioplasty was 5.016cm/sec.The mean Em velocity of basal medial septum at 3 months does not change significantly even after 3 months, even though the p value was less than 0.0001 significantly.

There is no change in early diastolic velocity before and after percutaneous transluminal coronary angioplasty showing relaxation of myocardium does not improve after percutaneous transluminal coronary angioplasty.

Table 6

Am velocity of basal medial septum 24 hours before PTCA, 24 hours after PTCA, 3 months after PTCA

	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Am	13.237	1.098	0.114	13.172	1.130	0.117	12.548	1.19	0.124
Two tailed p value	P= 0.0731 Not significant						P<0.0001 Significant		
95% CI	-0.006 to 0.135						0.553 to 0.694		

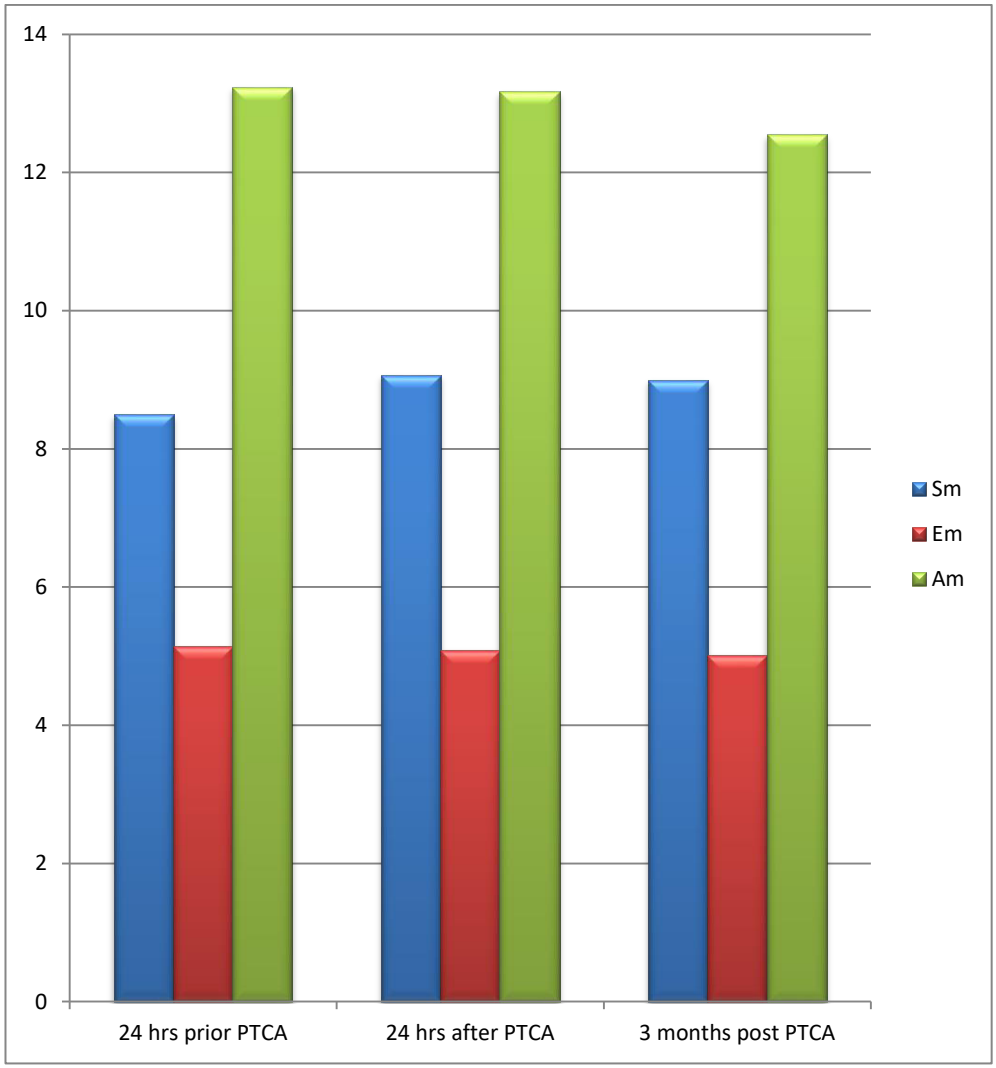
SD denotes standard deviation; SEM denotes standard error of mean. PTCA denotes percutaneous transluminal coronary angioplasty.CI denotes confidence interval.p denotes probability.

The average Am late diastolic tissue velocity of basal medial septum 24 hours before Percutaneous Transluminal Coronary Angioplasty was 13.237cm/sec.

The average Am late diastolic tissue velocity of basal septum 24 hours after Percutaneous Transluminal Coronary Angioplasty was 13.172 cm/sec with p value of equal to 0.0731.This is not statistically significant.

At 3 months post Percutaneous Transluminal Coronary Angioplasty, the average Em velocity of basal medial septum was 12.548 cm/sec with p value of less than 0.0001.

This is statistically significant,but the absolute change in average late diastolic velocity was not significant even after 3 months,indicating no improvement in diastolic function after Percutaneous Transluminal Coronary Angioplasty.



Sm-peak systolic velocity;Em-early diastolic velocity;Am late diastolic velocity.PTCA-percutaneous transluminal coronary angioplasty.

Figure 4

Trend of tissue doppler imaging finding medial basal septum of left ventricle

Table 7

Sm velocity of basal lateral wall of Left Ventricle 24 hours before PTCA, 24 hours after PTCA, 3 months after PTCA

	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Sm	10.141	0.743	0.077	10.284	0.744	0.077	10.244	0.72	0.075
Two tailed p value	P<0.0001 Significant						P=0.0630 Not significant		
95% CI	-0.189 to -0.097						-0.002 to 0.080		

SD means standard deviation; SEM means standard error of mean;Sm peak systolic velocity;PTCA - percutaneous transluminal coronary angioplasty;p - probability

The basal lateral wall Sm velocity of left ventricle 24 hours before Percutaneous Transluminal Coronary Angioplasty increased from 10.141cm/sec to 10.284cm/sec 24 hours after Percutaneous Transluminal Coronary Angioplasty.The basal lateral wall Sm velocity left ventricle was 10.244cm/sec 3 months post Percutaneous Transluminal Coronary Angioplasty.

The p value 24 hours after Percutaneous Transluminal Coronary Angioplasty was less than 0.0001 and is more significant. Three months post Percutaneous Transluminal Coronary Angioplasty, p value was equal to 0.0630 which is not significant statistically.

The change in Sm velocity 24 hours before; 24 hours after Percutaneous Transluminal Coronary Angioplasty and 3 months after Percutaneous Transluminal Coronary Angioplasty was similar.

This shows there is no improvement in left ventricular systolic function of lateral basal wall after percutaneous transluminal coronary angioplasty.

Table 8

Em velocity of basal lateral wall of Left Ventricle 24 hours before PTCA, 24 hours after PTCA, 3 months after PTCA

	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Em	8.927	0.816	0.085	8.873	0.831	0.086	8.855	0.802	0.083
Two tailed p value	P = 0.0536 Not significant						P = 0.3879 Not significant		
95% CI	-0.001 to 0.108						-0.024 to 0.080		

SD denotes standard deviation; SEM denotes standard error of mean;PTCA denotes percutaneous transluminal coronary angioplasty;Em denotes early diastolic velocity;p denotes probability;CI denotes confidence interval.

Mean Early diastolic velocity Em of lateral basal wall of left ventricle changed from 8.927 cm/sec 24 hours before Percutaneous Transluminal Coronary Angioplasty to 8.873cm/sec 24 hours after Percutaneous Transluminal Coronary Angioplasty with p value =0.0536 which is not significant.

The mean early diastolic velocity Em of lateral basal wall of left ventricle changed from 8.873cm/sec 24 hours after Percutaneous Transluminal Coronary Angioplasty to 8.855cm/sec 3 months after Percutaneous Transluminal Coronary Angioplasty.

This p value was equal to 0.38 and is not significant.

This is indicating that there is no improvement in left ventricular diastolic function after Percutaneous Transluminal Coronary Angioplasty.

Table 9

Am velocity of basal lateral wall of Left Ventricle 24 hours before PTCA, 24 hours after PTCA, 3 months after PTCA

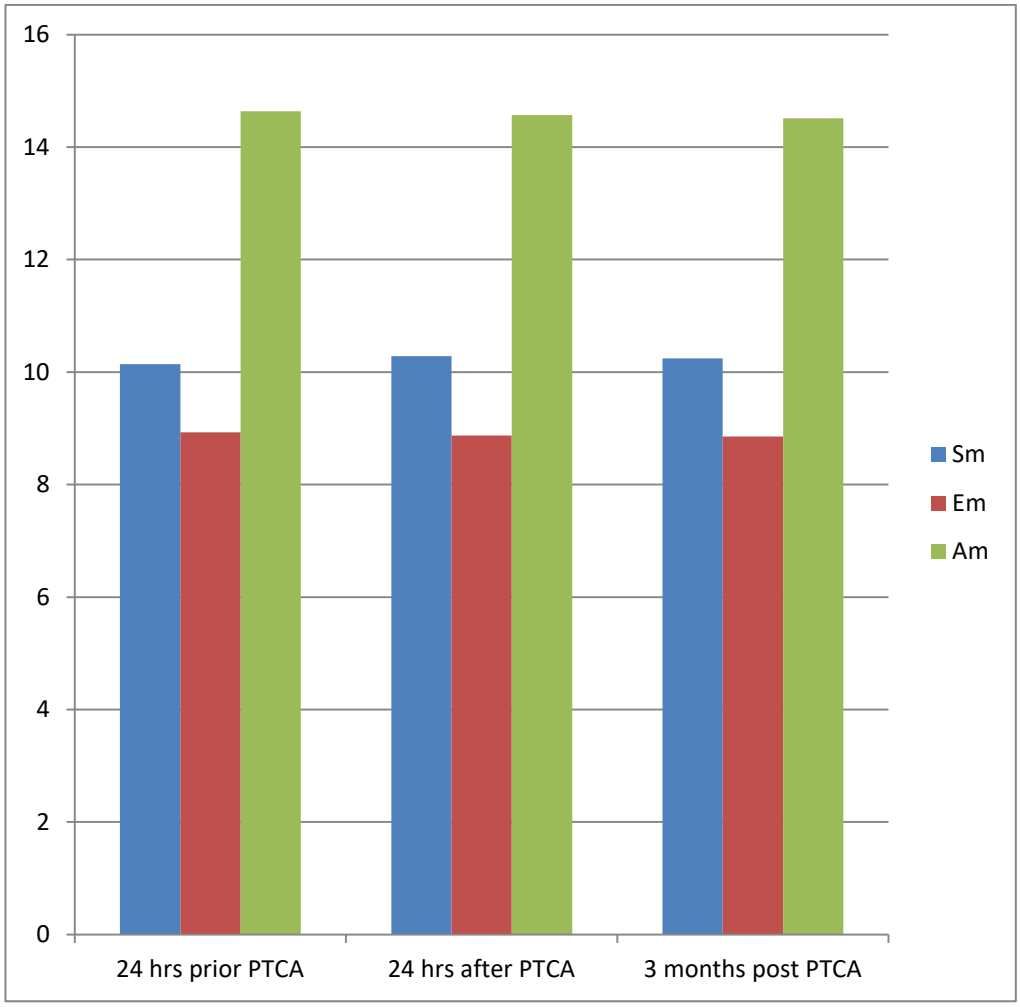
	24hours before PTCA			24 hours after PTCA			3 months after PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
Am	14.637	0.997	0.103	14.570	0.959	0.099	14.511	0.97	0.101
Two tailed p value	P = 0.0040 Significant						P = 0.0004 Significant		
95% CI	0.022 to 0.112						0.027 to 0.091		

SD denotes standard deviation; SEM denotes standard error of mean;Am denotes late diastolic velocity;PTCA denotes percutaneous transluminal coronary angioplasty;p denotes probability;CI denotes confidence interval.

The peak late diastolic velocity Am lateral basal wall of left ventricle changed from 14.637 cm/sec to 14.570 cm/sec 24 hours after Percutaneous Transluminal Coronary Angioplasty with p value=0.0040 which is significant.

The late diastolic velocity of basal lateral wall of left ventricle Am at 3 months post Percutaneous Transluminal Coronary Angioplasty was 14.511cm/sec with p value=0.0004 and was significant.

But the average late diastolic velocity values was similar 24 hours before;24 after and 3 months post percutaneous transluminal coronary angioplasty,showing there was no improvement in diastolic function.



Sm denotes peak systolic velocity;Em denotes early diastolic velocity;Am denotes late diastolic velocity;PTCA denotes percutaneous transluminal coronary angioplasty;numbers in centimeter per second.

Figure 5

Trends of tissue doppler imaging values of basal lateral wall of left ventricle

Table 10

End Diastolic Dimension of Left Ventricle

	24 hours before PTCA			24 hours after PTCA			3 months post PTCA		
Variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
EDD	51.49	3.43	0.36	51.40	2.65	0.28	50.88	2.57	0.27
Two tailed p value	P = 0.6017 Not significant						P = 0.0064 Significant		
95% CI	-0.27 to 0.46						0.15 to 0.88		

SD denotes standard deviation; SEM denotes standard error of mean;PTCA denotes percutaneous transluminal coronary angioplasty;p denotes probability;CI denotes confidence interval.EDD denotes end diastolic dimension.

End diastolic dimension 24 hours before Percutaneous Transluminal Coronary Angioplasty was 51.49 cm and 24 hours after Percutaneous Transluminal Coronary Angioplasty was 51.40 cm with p value = 0.6017 .There is no significant change in End diastolic dimension. End diastolic dimension decreased significantly after 3 months post Percutaneous Transluminal Coronary Angioplasty to 50.88 cms with significant p value 0.0064.

Table 11

End Systolic Dimension of Left Ventricle

	24 hours before PTCA			24 hours after PTCA			3 months post PTCA		
variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
ESD	38.94	2.76	0.29	39.15	2.35	0.24	39.11	2.29	0.24
Two tailed t test p value	P=0.2673 Not significant						P=0.8348 Not Significant		
95% CI	-0.60 to 0.17						-0.37 to 0.45		

SD denotes standard deviation; SEM denotes standard error of mean;ESD denotes End Systolic Dimension;PTCA denotes Percutaneous Transluminal Coronary Angioplasty;p denotes probability;CI denotes confidence interval.

End systolic dimension increased from 38.94 cm to 39.15 cm 24 hours post Percutaneous Transluminal Coronary Angioplasty with p value = 0.2673.This change in end systolic dimension was not significant.Three months post Percutaneous Transluminal Coronary Angioplasty the end systolic dimension was 39.11cm with p value = 0.8348 and was not significant with paired two tailed t test .

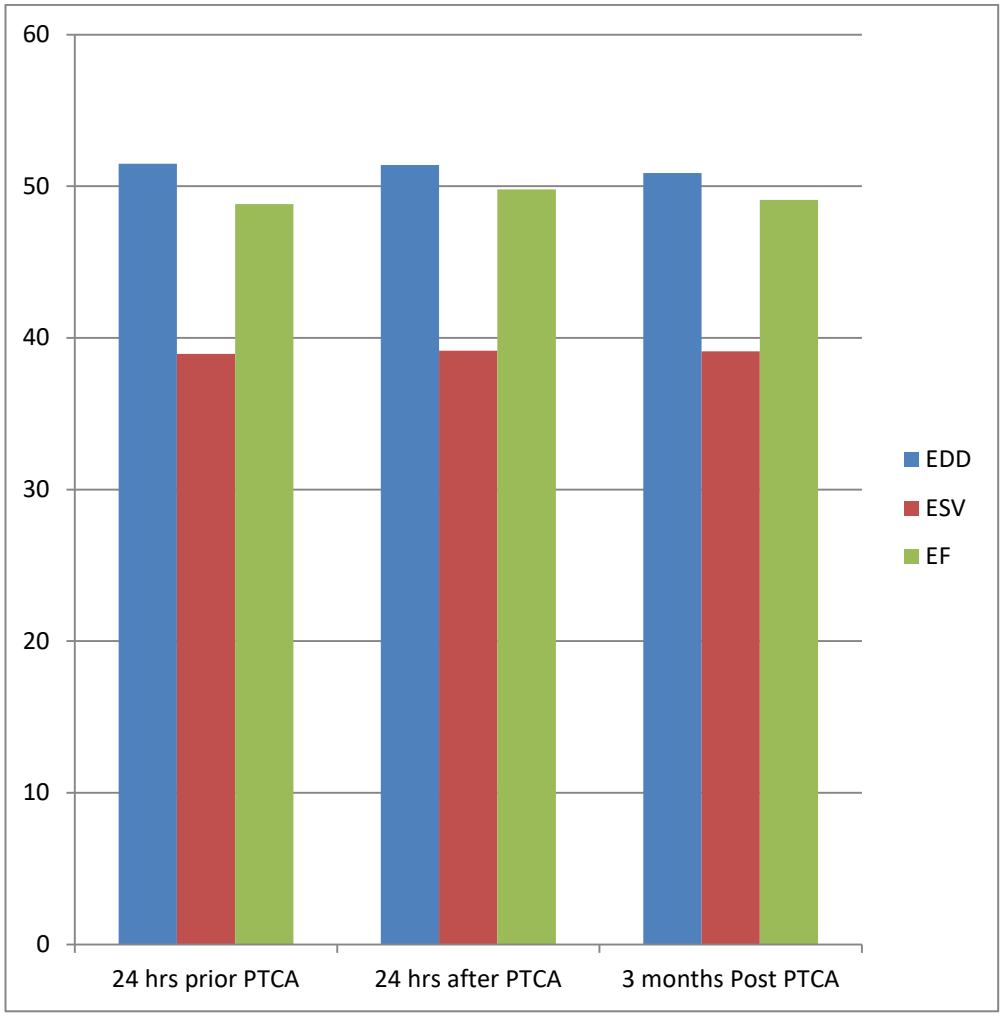
Table 12

Change in 2D Ejection Fraction

	24 hours before PTCA			24 hours after PTCA			3 months post PTCA		
variables	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**
EF	48.834	1.836	0.190	49.79	2.426	0.252	49.095	2.295	0.238
Two tailed p value	P = 0.0024 Significant						P = 0.0285 Significant		
95% CI	-1.564 to -0.348						0.075 to 1.317		

SD denotes standard deviation; SEM denotes standard error of mean;EF denotes ejection fraction;p denotes probability;PTCA denotes percutaneous transluminal coronary angioplasty.

Ejection Fraction 24 before Percutaneous Transluminal Coronary Angioplasty was 48.834 % and 24 hours post Percutaneous Transluminal Coronary Angioplasty was 49.79%.The p value was 0.0024 and was significant.Ejection Fraction 3 months post Percutaneous Transluminal Coronary Angioplasty was 49.095% with p value of 0.0285 which was significant.



EDD denotes End Diastolic Dimension;ESD denotes End Systolic Dimension;EF denotes Ejection Fraction;hrs denotes hours;PTCA denotes Percutaneous Transluminal Coronary Angioplasty.numbers in centimeter

Figure 6

Trends of End Diastolic Dimension, End Systolic Dimension and Ejection Fraction

Table 13

Changes in Em/Am ratio 24 hours before;24 hours after and 3 months post PTCA

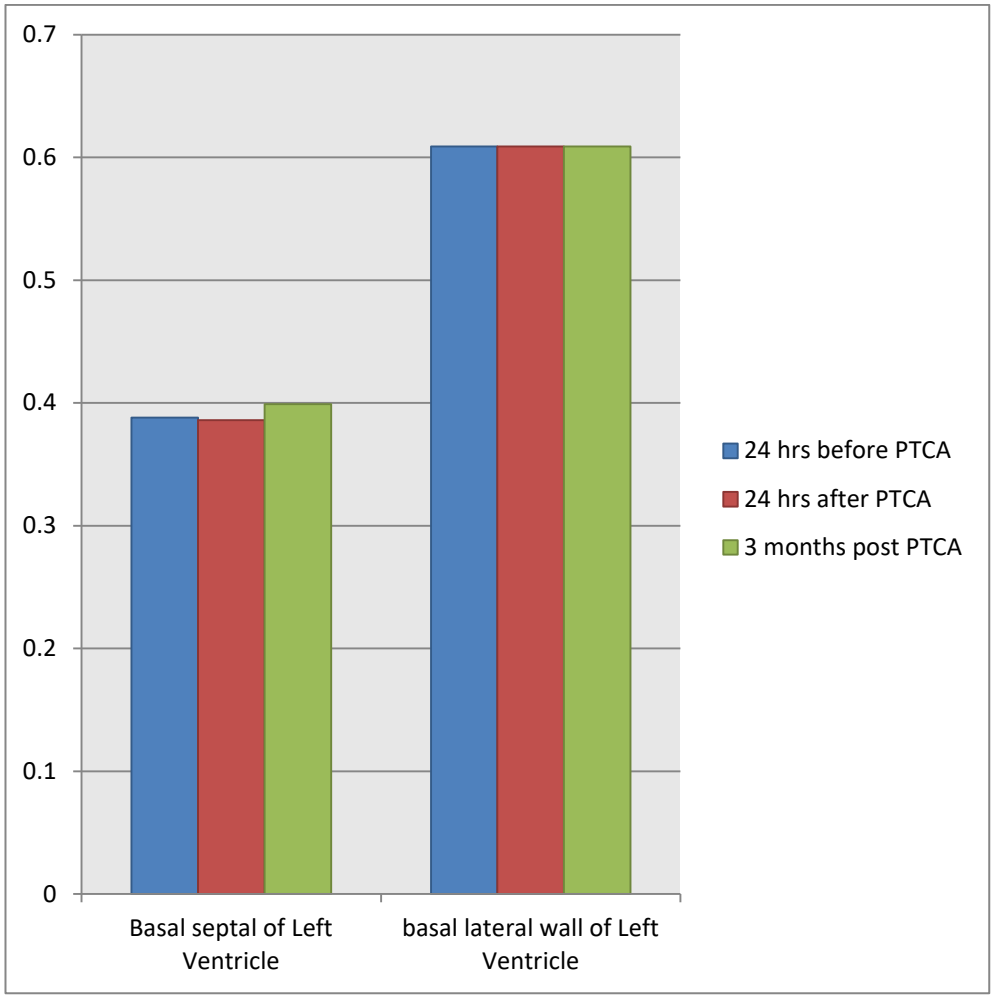
Variables	Basal septal wall of LV			Basal lateral wall of LV		
	24 hrs before PTCA	24 hrs after PTCA	3 months after PTCA	24 hrs before PTCA	24 hrs after PTCA	3 months after PTCA
Em	5.141	5.09	5.016	8.927	8.873	8.855
Am	13.237	13.172	12.548	14.637	14.570	14.51
Em/Am	0.388	0.386	0.399	0.609	0.608	0.610

LV denotes left ventricle;Em denotes early diastolic velocity;Am denotes late diastolic velocity;PTCA denotes percutaneous transluminal coronary angioplasty

Em velocity of basal medial septum and basal lateral wall of left ventricle was similar 24 hours before,24 hours after and 3 months post Percutaneous Transluminal Coronary Angioplasty.

Similarly Am velocity of basal medial septum and basal lateral wall of left ventricle also does not change significantly 24 hours before, 24 hours after and 3 months after Percutaneous Transluminal Coronary Angioplasty.

There was no significant change in Em/Am ratio of both basal septum and basal lateral wall of left ventricle denoting there is no improvement in left ventricular diastolic function after Percutaneous Transluminal Coronary Angioplasty



Hrs denotes hours;PTCA denotes Percutaneous Transluminal Coronary Angioplasty;numbers in centimeters/second

Figure 7

Trend of Em/Am ratio

DISCUSSION

DISCUSSION

Majority of patients in this study were males and only 8 were females. There was selection bias and the sample volume was only 93 which is less.

Smoking is the most common risk factor in our study followed by Diabetes Mellitus.35 smokers also had Diabetes Mellitus as risk factor for Coronary Heart Disease.

Peak systolic velocity(Sm) of basal septum of left ventricle increased significantly 24 hours after PTCA and 3 months after Percutaneous Transluminal Coronary Angioplasty. This increase in peak myocardial systolic velocity indicates there is a definite increase in left ventricle systolic function after percutaneous coronary angioplasty.

There is a phenomenal increase in peak myocardial systolic velocity of basal lateral wall of left ventricle 24 hours after coronary angioplasty, but there is no increase after 3 months.

This increase in peak systolic myocardial velocity indicates a very good recovery of myocardium after percutaneous transluminal coronary angioplasty.

Em velocity and Am velocity of basal medial septum does not increase significantly immediately after percutaneous coronary angioplasty with stenting. Hence the diastolic function of left ventricle takes some time to improve after angioplasty even though the systolic function on ventricles increase within a day.

Early diastolic and late diastolic velocity of basal medial septum increased significantly after 3 months. So the diastolic function improvement takes more time, in our study.

The peak systolic myocardial velocity of basal lateral wall of Left ventricle changed upwards within a day after angioplasty, but very less change after 3 months. This may be due to the fact that already there is good improvement in left ventricle systolic function within a day of angioplasty.

Diastolic function of lateral basal wall of left ventricle does not increase even after 3 months. The reason for lack of improvement in diastolic function may be because lateral wall of left ventricle is not supplied by left anterior descending coronary artery and these patients do not have disease in left circumflex coronary artery.

End diastolic and end systolic dimension changed significantly after 3 months of angioplasty and ejection fraction also increased after few months.

As per prior studies, our study in Indian patients also showed the effect of ischemia on longitudinal function of left ventricle.

Based on our analysis regional contraction abnormality of ventricles could be derived with Doppler tissue imaging. More over the improvement in left ventricle systolic function is preserved after 3 months post coronary angioplasty.

Study limitations

Tissue Doppler imaging values was affected by pull and drag of adjacent myocardial segments leading to underestimation or overestimation. The exact place where sample volume was placed can change between examinations so the values obtained with tissue Doppler will also vary. This limitation can be removed by using strain and strain rate imaging technique.

Again strain rate imaging is not available in all institutions. Myocardial velocity gradient was not measured which indicates viable

myocardium. With speckle tracking there is no angle dependence during measurement.SPECT myocardial perfusion imaging is the gold standard to assess the reperfusion of ventricle, but again it is costly and not available in all centres.

CONCLUSION

CONCLUSION

From our prospective follow up study,we showed that tissue Doppler myocardial imaging indices such as Sm, Em, Am will be helping us to decide the improvement in left ventricle function following angioplasty.

Our findings are similar to previous animal and human studies. In conclusion we can use tissue Doppler imaging as an easily available technique to assess the reperfusion and change in regional ventricle function and success of angioplasty.

BIBLIOGRAPHY

BIBLIOGRAPHY

1.Dr Murat Cayli et al The effect of successful elective percutaneous coronary intervention on left ventricular functions assessed with tissue Doppler imaging method.TGKD .2007;11:146-150

2. Horie H, Takahashi M, Minai K et al.Long term beneficial effect of late reperfusion for acute anterior myocardial infarction with percutaneous transluminal coronary angioplasty. Circulation 1998; 98:2377-82.

3.Strotmann JM Richter A,Kukulski T et al,Doppler myocardial imaging in the assessment of regional myocardial function in longitudinal direction pre and post-PTCA Eur J Echocardiogram 2001;2:178-86.

4.Arco J Teske,Bart WL De Boeck,Paul G Melman et al Echocardiographic quantification of myocardial function using tissue deformation imaging, a guide to image acquisition and analysis using tissue Doppler and speckle tracking.Cardiovascular ultrasound 2007,5:27

5.Hafiz ur Rahman,Sher Bahadar Khan,Lubna Noor et al Assessment of left ventricular systolic and diastolic function by tissue Doppler imaging after acute myocardial infarction.J Ayub Med coll Abbottabad 2011;23(2).

6. Philip M Mottram, Thomas H Marwick. Assessment of diastolic function: what the general cardiologist needs to know. Heart 2005; 91:681-695.

7.Mei Wang ,MD,Gabriel W.K.Yip,MRCP;Angela Y.M.Wang MB et al Peak early diastolic mitral annulus velocity by tissue Doppler imaging adds independent and incremental prognostic value.J Am Coll Cardiol 2003;41(5):820-826.

8. Derumeaux G, Ovize M, Loufoua J, et al: Doppler tissue imaging quantitates regional wall motion during myocardial ischemia and reperfusion. Circulation 1998, 97:1970-1977.

9.Klisiewicz A,Michalek P,Witkowski A et al Evaluation of left ventricular diastolic function with tissue Doppler echocardiography(TDI) in patients after angioplasty of the artery responsible for infarction. Review drug 2002; 59(8):655-7 article in polish.

10.Park SM,Miyazaki C,Prasad A et al Feasibility of prediction of myocardial viability with Doppler tissue imaging following percutaneous coronary intervention for ST elevation anterior myocardial infarction.J Am Soc Echocardiogr.2009 Feb;22(2):183-9.

11.Minamihaba O,Takeishi Y,Hirono O et al Pulsed Doppler tissue imaging for the assessment of myocardial viability: comparison with 99mTc sestamibi perfusion imaging.Nucl Med Commun. 2002 Dec; 23(12):1197-204.

12.Tumuklu M,kayikcioglu M,Aliyev E et al Evaluation of early alterations in transmitral diastolic flow and tissue Doppler findings of the basal segments of both ventricles in early period after coronary angioplasty Department of cardiology,Ege Medical Faculty, Izmir 2003 Mar;3(1):16-23,AXVII-AXVIII.

13.Hasan Shemirani,Kajhal Karimi,Reza Madadi Evaluation of early alterations in transmitral diastolic flow and tissue Doppler imaging findings of the septal and

lateral segments of the left ventricle in the early period after coronary angioplasty.Arya Atherosclerosis volume 7;special issue 2012.

14.Penicka M,Bartunek J,Wijns W et al Tissue Doppler imaging predicts recovery of left ventricular function after recanalization of an occluded coronary artery.J Am Coll Cardiol 2004 Jan 7;43(1):85-91.

15. Karl Isaaz MD, FESC, FACC Tissue Doppler imaging for the assessment of left ventricular systolic and diastolic functions. Current Opinion in Cardiology 2002, 17:431-442.

16.Rushmer RF,Crystal DK,Wagner C:The functional anatomy of ventricular contraction.Circ Res 1952,1:162-170.

17. Hatle L, Angelsen B: Pulsed and continuous wave Doppler in diagnosis and assessment of various heart lesions. In Doppler Ultrasound in Cardiology. Edited by Hatle L, Angelsen B, and Philadelphia: Lea and Febiger; 1985:97-292.

18.Carolyn Y Ho,Scott D.Solomon.AClinician's Guide to Tissue Doppler Imaging .circulation 2006;113:e396-e398.

19. Jae k oh MD, James B Seward, A.Jamil Tajik The Echo Manual.3rd edition.

20. Gulati VK, Katz WE, Follansbee WP, et al.Mitral annular descent velocity by tissue Doppler echocardiography as an index of global left ventricular function. Am J Cardiol 1996, 77:979-984?

21.Mishiro Y,Oki T,Yamada H et al.Evaluation of left ventricular contraction abnormalities in patients with dilated cardiomyopathy with the use of pulsed tissue Doppler imaging.J Am Soc Echocardiogr 1999,13:913-920.

22. Isaaz K, Munoz L, Lee E, et al: Quantitation of the cardiac base motion in normal man by Doppler echocardiography.J Am Soc Echocardiogr 1993, 6:166-176.

23. Bach DS, Armstrong WF, Donovan CL, et al: Quatitative Doppler tissue imaging for assessment of regional myocardial velocities during transient ischemia and reperfusion. Am Heart J 1996, 132:721-725.

24..Bountionkos M,Schinkel AF,Bax JJ et al.Pulsed-wave tissue Doppler quantification of systolic and diastolic function of viable and non viable myocardium in patients with ischemic cardiomyopathy. Am Heart J.2004; 148:1079-1084.

25. F Yalcin, A Kaftan, H Muderrisoglu et al Is Doppler tissue velocity during early left ventricular filling preload independent?Heart 2002,April;87(4):336-339.

26. Isaaz K, Munoz L, Lee E et al: Doppler Echocardiographic measurement of low velocity motion of the left ventricular posterior wall. Am J Cardiol 1989, 64:66-75?

27. Sohn DW, Chai IH, Lee DJ et al: Assessment of mitral annulus velocity by Doppler tissue imaging in the evaluation of left ventricular diastolic function.J Am Coll Cardiol 1997, 30:474-480.

28.SherifF.Nagueh,MD,chair,Christopher.P.Appleton,MD,Thierry C.Gillebert,MD et al.Recommendations for the evaluation of left ventricular diastolic function by Echocardiography, guidelines and standards. Journal of the American Society of Echocardiography 2009; volume22 Nov 2:108-133.

PROFORMA

PROFORMA

Name: Age: Sex: Ip No:

Chief Complaints:

Past History:

Risk Factors:

General Examination:

Pulse Rate:

Blood Pressure:

Cardiovascular Examination:

Respiratory System:

Abdominal Examination:

Nervous System Examination:

Investigations:

Random Blood Sugar

Blood Urea

Serum Creatinine:

Electrocardiogram:

Chest Radiograph:

Echocardiogram:

Plax(Parasternal Long Axis)

M Mode:

End Diastolic Dimension

End Systolic Dimension

Ejection Fraction

Tissue Doppler Imaging

24 Hours Before Percutaneous Transluminal Coronary Angioplasty

Basal Medial Septum Basal Lateral Wall Lv

Sm Em Am Sm Am Em

24 Hours After Percutaneous Transluminal Coronary Angioplasty

Basal Medial Septum Basal Lateral Wall Lv

Sm Em Am Sm Em Am

3 Months Post Percutaneous Transluminal Coronary Angioplasty

Basal Medial Septum Basal Lateral Septum

Sm Em Am Sm Em Am

MASTER CHART 1

S.No	NAME	AGE	SEX	IP NO	CAG NO	CLINICAL PRESENTATION	RISK FACTORS	PULSE RATE	sys bp	diastolic bp	B.GLUCOSE	B.UREA	S.CREATININE	RWMA	STENT SIZE	
1	SHAGUL HAMEED	46	M	30060	33	AWMI	DM	61	110	80	189	25	0.9	PRESENT	3	28
2	NARAYANAN	62	M	30064	34	AWMI	HT	58	124	82	110	27	1	PRESENT	3	24
3	RAVI	54	M	34264	43	AWMI	DM,SMOKER	81	130	80	148	28	0.8	PRESENT	2.75	18
4	JOTHEESWARI	37	F	34292	55	AWMI	DM	90	120	80	153	32	0.9	PRESENT	2.5	14
5	ANBARASU	45	M	32136	58	AWMI	SMOKER	81	130	80	163	36	0.7	PRESENT	3	18
6	THIRUMANI	58	M	32628	73	AWMI	DM ,SMOKER	67	120	80	181	23	0.8	PRESENT	3	23
7	SUBRAMANIYAN	52	M	33613	81	AWMI	DM ,SMOKER	73	110	80	190	27	0.9	PRESENT	3	15
8	ELUMALAI	65	M	37693	105	AWMI	DM,HT,SMOKER	75	150	80	202	30	0.4	PRESENT	3	15
9	MUTHIAH	52	M	38282	115	AWMI	DM,HT,SMOKER	91	140	80	182	27	0.7	PRESENT	3	23
10	SARAVANAN	30	M	38465	120	AWMI	DM SMOKER	83	130	80	190	28	0.8	PRESENT	3	23
11	CHINNAKANI	55	M	37098	133	AWMI	DM,SMOKER	74	140	80	206	31	0.9	PRESENT	3	18
12	MOHAN	51	M	37941	147	AWMI	DM,HT,SMOKER	59	140	82	130	23	0.7	PRESENT	3	18
13	ARULMURUGAN	36	M	38035	148	AWMI	SMOKER	63	130	80	110	25	0.5	PRESENT	3.5	15

14	GANESH	30	M	40741	154	AWMI	SMOKER	91	150	90	112	28	0.6	PRESENT	3	24
15	RAMALINGAM	52	M	36944	168	AWMI	DM,SMOKER	82	110	80	89	31	0.7	PRESENT	2.75	24
16	RAMALINGA RAJ	54	M	40538	185	AWMI	DM,SMOKER	79	130	80	132	23	0.8	PRESENT	2.75	15
17	PUSHPA	67	F	41357	208	AWMI	DM	58	140	80	141	25	0.7	PRESENT	3	24
18	RAJESWARI	67	F	43877	209	AWMI	DM,HT	52	160	80	150	28	0.8	PRESENT	2.75	28
19	KARUNANIDHI	59	M	45297	229	AWMI	DM,SMOKER	51	110	80	128	31	0.8	PRESENT	3.5	15
20	RAJESWARI	46	F	48010	278	AWMI	DM	50	130	80	160	25	0.8	PRESENT	2.75	18
21	MOHAN	41	M	43777	288	AWMI	DM,HT,SMOKER	62	140	84	129	28	0.8	PRESENT	3	24
22	IQBAL	54	M	46401	300	AWMI	HT,SMOKER	93	130	80	131	31	0.8	PRESENT	3	18
23	RAJA	48	M	51573	329	AWMI	DM,HT,SMOKER	50	110	80	126	25	0.9	PRESENT	3	24
24	INDHU CHOLAN	52	M	45830	347	AWMI	DM,HT	60	130	90	125	26	0.9	PRESENT	3.5	18
25	MAHENDRAN	40	M	54584	379	AWMI	DM,HT,SMOKER	78	140	80	138	31	0.9	PRESENT	3	18
26	KALAISELVAN	54	M	56333	404	AWMI	DM	89	110	80	128	28	0.8	PRESENT	3.5	18
27	MUBARAKHAN	48	M	54404	425	AWMI	DM,HT	57	130	80	129	21	0.9	PRESENT	2.75	28
28	CHUTTIMA	42	F	54853	431	AWMI	DM	63	110	80	138	25	0.8	PRESENT	3.5	23
29	NARAYANASAMY	50	M	55441	440	AWMI	DM,HT	59	130	80	181	31	0.8	PRESENT	3.5	18
30	SARASWATHY	55	F	53490	449	AWMI	DM	60	110	80	137	28	1	PRESENT	3	23
31	DHARMALINGAM	52	M	56169	451	AWMI	DM,SMOKER	71	140	80	129	28	0.9	PRESENT	3	28
32	MARIYAPPAN	52	M	56891	461	AWMI	SMOKER	73	130	80	120	25	0.8	PRESENT	3	18
33	ARJUNAN	46	M	56986	462	AWMI	DM,HT,SMOKER	75	130	80	110	31	0.8	PRESENT	3	15
34	RAMASAMY	44	M	61026	518	AWMI	DM,HT	78	140	80	102	28	0.9	PRESENT	3	15
35	SHAGUL HAMEED	46	M	63821	526	AWMI	DM,SMOKER	80	110	80	89	25	0.9	PRESENT	2.75	23
36	SELVARAJ	44	M	64127	530	AWMI	DM,SMOKER	81	140	80	79	29	0.9	PRESENT	3	28
37	KANAGARAJ	47	M	62457	532	AWMI	DM,SMOKER	83	130	80	100	31	0.7	PRESENT	2.5	12

38	USHA	55	F	62278	538	AWMI	DM	94	110	80	101	28	0.7	PRESENT	2.5	15
39	BABU	55	M	65082	547	AWMI	SMOKER	65	140	80	106	31	0.8	PRESENT	2.75	24
40	KANNAN	54	M	66375	573	AWMI	DM	70	110	80	108	35	0.9	PRESENT	2.75	18
41	SENTHIL KUMAR	45	M	65281	594	AWMI	DM,SMOKER	71	140	80	131	25	1.1	PRESENT	3	23
42	RAGHUNATHAN	48	M	63496	601	AWMI	DM,HT,SMOKER	67	140	82	149	31	0.9	PRESENT	3.5	23
43	RAMADOSS	64	M	70297	641	AWMI	DM,HT	68	140	84	128	27	0.8	PRESENT	2.75	18
44	GOVINDHAN	61	M	73387	684	AWMI	DM,SMOKER	72	130	80	102	28	0.7	PRESENT	2.75	28
45	MANJAPPAN	44	M	71521	699	AWMI	DM,SMOKER	81	110	80	100	21	0.8	PRESENT	3.5	24
46	VENKATESAN	68	M	77259	747	AWMI	DM,SMOKER	73	140	80	109	31	0.8	PRESENT	2.75	15
47	ANNAMALAI	60	M	75579	752	AWMI	DM,SMOKER	71	140	80	110	25	0.9	PRESENT	3	18
48	MARIMUTHU	53	M	73983	763	AWMI	DM	69	110	80	102	28	0.9	PRESENT	2.75	18
49	MURUGESAN	38	M	78274	762	AWMI	DM,SMOKER	75	130	80	94	26	0.8	PRESENT	3	15
50	CHINNASAMY	70	M	80666	783	AWMI	DM,SMOKER	65	140	80	82	31	0.9	PRESENT	3	18
51	VENKATARAMAN	48	M	82013	812	AWMI	DM,SMOKER	52	120	80	81	38	0.8	PRESENT	3	18
52	RENGANATHAN	56	M	81243	847	AWMI	DM,SMOKER	59	110	80	89	28	0.9	PRESENT	2.75	18
53	SUKUMAR	45	M	84290	853	AWMI	DM,SMOKER	69	140	80	82	25	0.8	PRESENT	2.5	23
54	MUTHU	64	M	82091	854	AWMI	DM,SMOKER	74	130	80	90	31	0.9	PRESENT	3	15
55	PALANISMAY	41	M	82669	867	AWMI	DM	63	140	80	92	32	0.9	PRESENT	2.5	18
56	SUDHAKAR	40	M	83206	875	AWMI	SMOKER	75	110	80	101	28	0.8	PRESENT	3	28
57	RAVISHANKAR	42	M	86703	898	AWMI	SMOKER	72	140	80	80	23	0.7	PRESENT	3.5	18
58	MASTHAN	55	M	83771	907	AWMI	DM,SMOKER	76	130	80	167	31	0.8	PRESENT	3	23
59	KRISHNAMURHTY	58	M	83141	913	AWMI	DM	79	120	80	152	27	0.8	PRESENT	3	23
60	AMMAM	47	F	86674	930	AWMI	DM	83	110	80	143	28	0.9	PRESENT	3	18
61	KARUPPAIAH	34	M	89964	944	AWMI	DM,SMOKER	82	140	80	130	25	0.8	PRESENT	2.75	28
62	DANIEL	57	M	91323	947	AWMI	DM,SMOKER	89	120	80	123	31	0.9	PRESENT	3.5	28
63	SUNDAR SAMY	39	M	85896	959	AWMI	SMOKER	90	140	80	130	26	0.8	PRESENT	3	24
64	ANANDHAN	45	M	88562	965	AWMI	SMOKER	58	110	80	128	25	0.8	PRESENT	3	18

65	RAVIARASU	46	M	92493	976	AWMI	SMOKER	62	120	80	137	31	0.8	PRESENT	3.5	18
66	MANOHARAN	37	M	93320	989	AWMI	DM,SMOKER	68	130	80	128	23	0.8	PRESENT	3	30
67	SATHISH	36	M	91307	996	AWMI	DM	65	140	80	135	28	0.8	PRESENT	2.75	18
68	DOSS	60	M	94100	1000	AWMI	SMOKER	71	110	80	128	26	0.9	PRESENT	3	23
69	SEKAR	45	M	94054	1003	AWMI	SMOKER	73	140	80	126	31	0.8	PRESENT	2.75	23
70	VELUMANY	45	M	95818	1004	AWMI	SMOKER	74	130	80	127	25	0.7	PRESENT	2.75	18
71	RAMESH	42	M	94084	1046	AWMI	DM,HT	74	120	80	127	26	0.8	PRESENT	2.75	28
72	SURESH	38	M	95641	1047	AWMI	DM,SMOKER	78	110	80	128	28	0.9	PRESENT	2.75	28
73	GANESH	36	M	94327	1053	AWMI	DM	69	140	80	137	23	0.8	PRESENT	2.5	28
74	SETHU	47	M	95008	1059	AWMI	DM,HT	63	130	80	143	31	0.8	PRESENT	2.75	23
75	RAGHU KUMAR	40	M	95021	1061	AWMI	DM,HT	73	140	80	156	24	0.8	PRESENT	3	23
76	ADAIKALAM	49	M	98044	1062	AWMI	SMOKER	80	120	80	147	28	0.8	PRESENT	3	18
77	SELVAM	55	M	95250	1063	AWMI	SMOKER	82	130	80	127	26	0.9	PRESENT	3	15
78	BALAJI	45	M	96185	1084	AWMI	DM,SMOKER	72	110	80	111	27	0.8	PRESENT	3	15
79	MARIYAPPAN	46	M	97472	1088	AWMI	DM,SMOKER	76	120	80	112	23	0.8	PRESENT	3.5	18
80	RAMKUMAR	48	M	97499	1090	AWMI	DM,SMOKER	57	130	80	112	31	0.9	PRESENT	2.5	28
81	ADHIKESAVAN	48	M	100693	1099	AWMI	HT,SMOKER	59	160	80	110	28	0.9	PRESENT	2.75	28
82	SELVARAJ	52	M	101118	1102	AWMI	SMOKER	60	130	80	112	31	0.8	PRESENT	2.5	23
83	RAMESH	45	M	98712	1103	AWMI	SMOKER	58	140	80	89	28	0.9	PRESENT	3	18
84	IYYASAMY	59	M	101392	1107	AWMI	SMOKER	74	120	80	93	26	0.8	PRESENT	3	28
85	VENKATASAMY	50	M	102083	1117	AWMI	DM,SMOKER	79	110	80	98	31	0.7	PRESENT	3	23
86	VARADHARAJAN	67	M	101703	1144	AWMI	SMOKER	59	130	80	87	28	0.8	PRESENT	2.75	18
87	RAVI	52	M	102213	1146	AWMI	SMOKER	63	140	80	100	29	0.9	PRESENT	3	18
88	RAJENDIRAN	46	M	104110	1147	AWMI	DM,SMOKER	68	120	80	126	23	0.8	PRESENT	3.5	18
89	SOLLAMUTHU	60	M	99598	1151	AWMI	SMOKER	74	110	80	104	21	0.7	PRESENT	2.5	28
90	FAZULUDEEN	62	M	105295	1165	AWMI	DM,SMOKER	69	130	80	171	28	0.8	PRESENT	2.75	23
91	SUBBAN	65	M	101812	1187	AWMI	DM,SMOKER	75	140	80	182	20	0.9	PRESENT	2.75	23
92	PONNURANGAN	62	M	104912	1188	AWMI	SMOKER	80	140	80	110	31	0.9	PRESENT	3	15
93	RAMAMOORTHY	56	M	104912	1191	AWMI	SMOKER	81	110	80	109	29	0.9	PRESENT	3	23

02 Master chart 2

S. No	Name	Tissue Doppler Imaging																	
		24 HOURS PRE PTCA						24 HOURS POST PTCA						3 MONTHS POST PTCA					
		BASAL SEPTAL WALL			BASAL LATERAL WALL			BASAL SEPTAL WALL			BASAL LATERAL WALL			BASAL SEPTAL WALL			BASAL LATERAL WALL		
		Sm	Em	Am	Sm	Em	Am	Sm	Em	Am	Sm	Em	Am	Sm	Em	Am	Sm	Em	Am
1	SHAGUL HAMEED	8.1	5.1	13.5	10.1	10.4	15.7	9.5	7.3	15.8	10.8	8.6	15.8	9.6	7.4	15.9	10.9	8.6	15.7
2	NARAYANAN	8.6	6.9	15.1	11.6	8.3	17.1	9.1	6.8	15	11.8	8.4	16.9	9	6.7	15.3	11.9	8.3	16.8
3	RAVI	8	4.1	11.4	9	11.3	14.8	8.9	4	11.6	9.3	11.2	14.9	8.7	4.1	11.1	9.2	11.1	14.8
4	JOTHEESWARI	8.9	4.7	15.3	9.6	8.9	13.5	9.4	4.6	15.1	9.8	8.8	13.5	9.2	4.4	14.4	9.9	8.9	13.6
5	ANBARASU	9.3	4.3	11.8	10	11.2	15.6	9	4.3	11.2	10	11.3	15.5	8.8	4.2	10.5	10.1	10.9	15.4
6	THIRUMANI	9.1	6.2	12	11.5	10.3	17	9.3	6.1	11.8	11.6	10.2	16.4	9.2	6	10.9	11.5	10.2	16.5
7	SUBRAMANIYAN	8.5	5.2	12.3	9.2	9.2	14.9	9.1	5.3	12.1	9.4	9.3	14.8	9.2	5.2	12.4	9.2	9.1	14.9
8	ELUMALAI	9.2	6.8	13.2	9.6	9.6	13.6	9.6	6.7	13.1	9.6	9.6	13.7	9.5	6.6	12.8	9.3	9.4	13.8
9	MUTHIAH	9.1	5.5	14	10.4	11	17	9.8	5.4	13.7	10.5	11.1	16.8	9.9	5.3	12.9	10.8	11.1	16.9
10	SARAVANAN	7.9	4.3	13.7	10.7	9.4	13.8	8.6	4.2	12.9	10.6	9.5	13.9	8.5	4.1	12.3	10.1	9.2	13.8
11	CHINNAKANI	8.1	5.1	12.5	11.1	10.2	14.8	9.4	5	12.4	11	10.3	14.6	9.2	4.9	11.7	10.8	10.3	14.7
12	MOHAN	7.6	6.6	11.9	11.6	10.4	13.3	8.2	6.5	11	11.7	10.5	13.4	8.4	6.4	9.4	11.3	10.7	13.2
13	ARULMURUGAN	8	5.4	12.5	9.2	8.4	15.3	9.3	5.3	12.6	9.3	8.5	15.2	9	5.2	11.9	9.6	8.7	15.1
14	GANESH	8.9	6	15	9.3	8.5	17.1	9.5	6.1	14.9	9.6	8.6	16.9	9.7	6	14.2	9.2	8.9	16.7
15	RAMALINGAM	9.3	4.5	14.3	11.3	11	13.6	9.8	4.6	14.4	11.8	11.1	13.7	9.7	4.3	13.7	11.2	10.8	13.8
16	RAMALINGARAJ	8	6.8	14.2	9.4	9.3	14.7	8.9	6.5	14.1	9.8	9.1	14.6	9	6.4	13.5	10.1	9.3	14.5
17	PUSHPA	8.1	4.2	12	10.2	9.8	13.7	9	4.3	11.8	10.6	9.6	13.8	8.9	4.2	11	9.9	9.4	13.9

18	RAJESWARI	8.7	4.7	11.9	11.7	9.5	14.8	9.1	4.6	11.7	11.9	9.2	14.2	8.9	4.5	10.8	11.8	9	14.1
19	KARUNANIDHI	8.6	5.1	12.6	10.9	9.3	13.2	9.4	5	12.5	10.9	9.2	13.4	9.3	4.8	11.4	10.6	9.3	13.5
20	RAJESWARI	8.3	4.5	13	9.5	8.9	15.2	9	4.6	12.9	9.8	9	15.1	9.1	4.7	11.8	9.9	8.8	15
21	MOHAN	8.8	4.8	12.3	10.6	9.5	14.5	9.6	4.6	12.3	10.7	9.6	14.6	9.3	4.5	11.3	10.6	9.4	14.5
22	IQBAL	8.9	4.3	11.9	9.6	8.9	15.2	9.8	4.3	11.8	9.5	9.1	15	9.7	4.2	11.6	9.6	9	14.9
23	RAJA	9	4.2	11.2	9.7	8.7	14.7	9.6	4.3	11.1	9.9	8.8	14.8	9.4	4.2	10.8	10.1	8.9	14.8
24	INDHU CHOLAN	8.1	4.8	11.4	10.8	9	14.7	9.6	4.7	11.3	10.9	9.2	14.9	9.6	4.6	10.6	10.6	9.1	14.7
25	MAHENDRAN	8.7	5.5	12.3	9.1	8.2	14.9	9.5	5.6	12.5	9.3	8.4	15	9.5	5.6	11.4	9	8.6	14.8
26	KALAISELVAN	8.3	6.2	14	10.9	9.3	13.6	9.1	6.1	13.6	10.8	9.4	13.4	8.9	6	12.9	10.3	9.3	13.2
27	MUBARAKHAN	8.6	5.8	11.4	9.8	8.7	17	9	5.6	11.2	9.9	8.9	17.1	9.1	5.5	11.4	9.6	9.1	16.9
28	CHUTTIMA	8.3	6	12.6	11.3	9.2	14.8	8.9	6	12.5	11.4	9.4	14.4	9	5.9	11.8	11.3	9.6	14.3
29	NARAYANASAMY	8.7	5.6	11.8	10.9	9.6	13.3	9	5.7	11.7	10.7	9.5	13	8.7	5.7	10.9	10.6	9.7	12
30	SARASWATHY	8.9	4.3	12.1	11	8.7	14.7	9.3	4.6	12	11.6	8.8	14.9	9.1	4.5	11.4	11.7	9	14.8
31	DHARMALINGAM	9.1	4.7	11.7	10.9	9.1	15.5	9.5	4.5	11.9	10.8	9	15.3	9.2	4.6	11.1	10.9	9.2	15.2
32	MARIYAPPAN	8.1	4.9	12.6	9.5	8.4	17	8.7	4.8	12.5	10.3	8.3	16.4	9.1	4.9	10.9	10.2	8.1	16.5
33	ARJUNAN	8.9	5	11.9	10.6	9.3	13.4	9.7	5.2	11.8	10.5	9.1	13	9.5	5.3	11.3	10.7	9.2	13.1
34	RAMASAMY	9	5.2	12.4	9.7	8.7	14.6	9.3	4.9	12.3	9.8	8.9	14.2	9.1	4.8	12	9.6	9.1	14.1
35	SHAGUL HAMEED	9.2	5.8	11.7	9.9	8.7	14.2	9.8	5.6	11.7	9.9	8.8	14	9.9	5.8	11.1	9.7	8.9	13.8
36	SELVARAJ	8	6.1	13.5	9.6	8.9	13.3	8.8	5.9	13.4	9.6	9.2	13	8.9	5.7	12.9	9.7	9.1	13.2
37	KANAGARAJ	7.8	4.6	13.2	10.6	10	15.4	8.2	4.5	13.1	10.7	10.4	15	8	4.6	12.8	10.8	9.8	14.9
38	USHA	8.3	4.8	12.6	10.6	9.2	14.3	9	4.8	12.8	10.4	9	14.5	8.8	4.7	12.3	10.5	8.9	14.3
39	BABU	8.5	5	11.5	9.3	8.4	15	9.1	4.9	11.6	9.4	8.2	15.1	8.9	4.9	11.1	9.5	8.1	15
40	KANNAN	8.9	4.9	13.6	9.4	8.6	14.6	9.4	5	13.5	9.7	8.5	14.5	9.3	4.8	13	9.8	8.3	14.6
41	SENTHIL KUMAR	8.2	6	14.1	9.9	8.9	14.8	9.3	5.9	14.4	9.4	8.8	14.7	9.4	5.4	13.9	9.5	8.7	14.6
42	RAGHUNATHAN	9	6.1	14.3	11.2	10.3	13.7	9.8	6	13.9	11.4	10.2	13.6	9.6	5.8	13.2	11.5	9.8	13.5

43	RAMADOSS	8.7	4.4	15.1	11	10.6	14.9	9.2	4.2	15.2	11.7	10.5	14.8	9.1	4	14.8	11.8	10.8	14.7
44	GOVINDHAN	8.4	4.3	14.6	9.6	8.2	14.5	9	4.3	14.4	9.7	8.1	14.6	8.8	4.1	13.8	9.8	8.5	14.5
45	MANJAPPAN	8.2	4.7	13.6	9.5	8.1	13.4	8.6	4.6	13.4	9.8	8	13.6	8.4	4.9	12.8	9.9	8.2	13.5
46	VENKATESAN	8.1	4.3	12.3	9.1	8.2	14.6	8.7	4.3	12.3	9.9	8.3	14.7	8.6	4.3	11.8	10	8.1	14.6
47	ANNAMALAI	8.9	4.2	11.3	10.1	8.2	14.2	9	4.2	11.2	10.3	8.2	14	9.2	4	10.4	10.2	8.3	13.9
48	MARIMUTHU	9.2	4.3	14.2	10.8	8.3	13.3	9.3	4.3	14.1	10.9	8.1	13.1	9.3	4.6	13.5	10.8	8.1	13
49	MURUGESAN	8.5	4.8	15	11.3	9.4	15.4	8.5	4.7	14.9	11.6	9.5	15.2	8.2	4.4	13.6	11.5	9.4	15
50	CHINNASAMY	8.6	4.7	13.8	10.4	9.2	14.3	9.5	4.6	13.7	10.5	9.3	14.5	9.5	4.2	13	10.4	9.2	14.6
51	VENKATARAMAN	8.3	4.9	12.6	10.6	8.9	15	9	4.8	12.4	10.7	9.1	15.2	8.9	4.6	11.7	10.8	9	15.3
52	RENGANATHAN	8.2	4.5	13.5	9.4	8.1	14.6	8.4	4.3	13.6	9.6	8.3	14.5	8.5	4.2	12.8	9.7	8.4	14.3
53	SUKUMAR	8.4	4.7	13.5	9.3	8.3	14.8	8.8	4.8	13.8	9.6	8.5	14.3	8.7	4.6	13.1	9.8	8.2	14.1
54	MUTHU	8.8	4.9	14.3	9.3	8.5	13.7	9	4.5	14.2	9.5	8.6	13.9	8.6	4.4	13.6	9.1	8.5	13.8
55	PALANISMAY	8.1	5.1	15.1	9.7	8.3	14.9	9.2	4.7	15	9.9	8.1	14.5	9.1	4.6	14.1	9.7	7.9	14.6
56	SUDHAKAR	8.9	5.3	12.7	10.4	9	14.5	9.4	5.3	12.9	10.5	8.9	14.3	9.3	5.3	11.6	10.6	8.7	14.2
57	RAVISHANKAR	8.3	4.8	13.1	9.5	8.7	13.8	9	4.6	13.3	9.6	9.3	14	9	4.8	12.7	9.8	9.4	13.8
58	MASTHAN	9.2	5.2	12.8	11.2	9.8	14.8	9.4	5	12.5	11.3	9.6	15	9.5	4.9	11.9	11.1	9.7	14.9
59	KRISHNAMURHTY	7.9	4.6	13	10.9	9.7	13.3	8.2	4.7	12.8	10.8	9.2	13.7	8.1	4.7	12.1	10.6	9.3	13.9
60	AMMAM	8.1	6	14.1	10.2	9.1	15.3	9.2	5.8	13.9	10.5	8.8	15.1	9.1	5.8	13.2	10.2	8.9	14.9
61	KARUPPAIAH	8.5	5.3	15.2	11.5	10	17.1	9.1	5.2	15.1	11.6	9.8	16.8	9	5.2	14.7	11.4	9.9	16.9
62	DANIEL	8.9	4.5	14.9	9.3	8.1	13.6	9.8	4.6	14.9	9.6	7.9	13.8	9.6	4.4	13.8	9.4	8.2	13.9
63	SUNDAR SAMY	8.1	5.2	13.6	9.6	8.3	14.7	9	5	13.4	9.8	8	14.9	8.9	4.9	13.2	9.6	7.8	14.8
64	ANANDHAN	9.2	4.5	13.2	10.1	8.6	13.7	9.8	4.6	13.1	10.5	8.3	13.9	9.8	4.5	12.6	10.3	8.3	14
65	RAVIARASU	8	5.6	11.7	9.6	8.3	14.8	8.5	5.5	11.8	9.9	8	14.7	8.4	5.6	11.9	9.8	8.2	14.8
66	MANOHARAN	7.9	4.3	12.8	9.9	8.2	13.2	8.3	4.2	12.6	10	7.9	13.1	8.2	4	11.9	9.9	8.4	13.2
67	SATHISH	8.3	5	13.8	9.1	8	14.7	8.8	4.9	13.7	9	7.8	14.8	8.7	4.8	13.6	9.1	8.2	14.9
68	DOSS	8.5	4.6	14.3	10.4	8.9	15.5	9.1	4.5	14.5	10.8	8.7	15.6	9	4.3	13.9	10.9	8.5	15.7
69	SEKAR	9.1	5.8	12.7	10.8	9	17	9.9	5.7	12.6	10.7	8.8	16.9	9.9	5.4	11.9	10.8	8.6	16.8

70	VELUMANY	8.3	4.7	14.8	9.9	8.7	13.4	8.5	4.6	14.9	9.8	8.6	13.2	8.5	4.6	13.9	9.9	8.7	13.1
71	RAMESH	8.4	4.7	13.5	9.3	8.4	14.6	8.4	4.8	13.3	9.3	8.5	14.7	8.5	4.6	12.7	9.2	8.7	14.6
72	SURESH	8.8	5	12.3	9.5	8.5	14.2	9.1	4.9	12.2	9.4	8.6	14.4	9	4.8	11.9	9.3	8.8	14.3
73	GANESH	8.3	5.8	14.3	9.4	8.9	13.3	8.9	6	14.2	9.7	8.8	13.1	8.8	5.9	13.6	9.8	8.6	13
74	SETHU	8.1	5.7	13.8	10.2	7.9	15.4	8.8	5.2	13.7	10.5	8	15.6	8.7	5.1	13.6	10.6	7.9	15.4
75	RAGHU KUMAR	8	6	12.6	11	9.2	14.3	8.3	5.6	12.7	11.3	9.1	14.1	8.9	5.5	12.4	11.2	9	14
76	ADAIKALAM	8.3	4.8	15	10.5	8.1	15	8.8	4.9	14.8	10.7	8.3	14.7	8.6	4.9	14.3	10.8	8.3	14.6
77	SELVAM	8.5	4.3	13.8	9.3	8	14.6	9	4.6	13.6	9.7	7.8	14.2	9.1	4.3	13.2	9.8	7.6	14.1
78	BALAJI	8.9	4.2	14	9.8	8.3	14.8	9.3	4.4	13.8	10	8.2	14.9	9.2	4.1	12.8	10.1	8.1	14.8
79	MARIYAPPAN	8.3	4.9	14.2	10.3	8.7	13.7	8.8	5.1	14	10.6	8.5	13.8	8.9	5.3	13.8	10.5	8.4	13.9
80	RAMKUMAR	8.2	5.1	12.6	9.1	7.8	14.9	8.5	4.7	12.9	9.4	8	14.7	8.4	4.9	12.5	9.5	7.8	14.8
81	ADHIKESAVAN	8.4	5.4	14.3	9.8	8	14.5	8.9	5.3	14.1	9.8	7.9	14.8	8.9	5.4	13.6	9.9	8.1	14.9
82	SELVARAJ	8.6	6.1	12.6	9.3	8.1	14.6	9.3	5.9	12.8	9.2	8	14.3	9.2	5.8	11.9	9.3	7.9	14.4
83	RAMESH	8.4	5.7	14.1	10.3	8.4	14.8	8.7	5.5	14.3	10.4	8.2	14.9	8.9	5.4	13.6	10.5	8	14.8
84	IYYASAMY	8.1	5.8	13.2	10.8	7.9	13.7	8.6	5.9	13.4	10.8	8	13.7	8.5	5.9	12.8	10.9	8.3	13.8
85	VENKATASAMY	8.5	6.1	13.9	10.6	8.7	14.9	8.8	6	14.1	10.7	8.8	14.7	8.6	5.8	13.6	10.8	8.7	14.8
86	VARADHARAJAN	8.2	4.8	14.3	9.3	8	14.5	9	4.6	13.7	9.6	7.9	14.3	8.8	4.8	13.2	9.7	8.1	14.2
87	RAVI	8.5	4.9	12.7	9.2	7.6	13.4	8.7	5.1	12.9	9.1	7.6	13.3	8.5	5.1	12.3	9.3	7.8	13.1
88	RAJENDIRAN	8.8	5.2	13.6	10.6	8.7	14.6	8.9	5	13.9	10.5	8.6	14.5	8.8	4.9	12.9	10.6	8.3	14.6
89	SOLLAMUTHU	8.1	5.3	14.6	9.4	7.9	14.2	9.3	4.9	14.2	9.4	7.4	14.1	8.9	4.8	13.6	9.3	7.3	13.9
90	FAZULUDEEN	8.9	6	13.2	9.9	8.1	13.3	8.9	5.8	13	9.8	8	13.1	8.8	5.8	12.3	9.9	7.8	12.9
91	SUBBAN	9	5.4	13.2	10.3	9	15.4	9.2	5.3	12.9	10.3	8.6	15.3	9	5.11	11.9	10.4	8.4	15.1
92	PONNURANGAN	7.5	5.5	12.7	10.9	8.8	14.3	8.2	5.4	13.1	10.9	8.6	14.2	8	5.3	12.3	10.6	8.5	14.1
93	RAMAMOORTHY	8.3	5.6	14.6	11	9.3	15.3	8.8	5.3	13.7	10.8	9	15.4	8.6	5.5	12.7	10.7	8.8	15.3

Sm -peak systolic velocity;Em - early diastolic velocity;Am - late diastolic velocity;PTCA - percutaneous transluminal coronary angioplasty

MASTER CHART 3

S.No	Name	BEFORE PTCA			24 HRS AFTER PTCA			3 MONTHS POST PTCA		
		EDD	ESD	EF	EDD	ESD	EF	EDD	ESD	EF
1	SHAGUL HAMEED	48	37	51	49	38	49	48	37	50.6
2	NARAYANAN	57	43	53	57	44	50.4	56	45	45
3	RAVI	55	40	57	54	39	50	54	38	55.5
4	JOTHEESWARI	49	38	50	53	41	50	54	42	44.5
5	ANBARASU	47	35	48	49	38	50	48	37	50.6
6	THIRUMANI	53	42	47	54	39	50	53	42	47
7	SUBRAMANIYAN	55	41	54	53	42	47	51	41	45
8	ELUMALAI	47	36	51	48	37	50.6	48	37	50.6
9	MUTHIAH	53	41	50	53	42	47	51	41	45
10	SARAVANAN	55	41	47	55	41	47	55	41	47
11	CHINNAKANI	57	43	53	55	41	47	55	43	48
12	MOHAN	47	35	48	46	37	45.3	47	37	41
13	ARULMURUGAN	49	38	49	49	39	46.7	49	37	52
14	GANESH	51	41	45	53	41	54	51	41	45
15	RAMALINGAM	47	35	47	47	36	51	47	36	51
16	RAMALINGA RAJ	55	41	47	54	39	50	53	42	47
17	PUSHPA	55	40	50	53	42	47	53	41	50.2
18	RAJESWARI	47	36	51	48	37	50.6	47	36	51
19	KARUNANIDHI	53	42	47	53	41	50.2	51	40	48.5
20	RAJESWARI	47	35	47	48	37	50.6	46	37	45.3
21	MOHAN	54	39	50	54	38	55.5	57	43	53
22	IQBAL	50	39	49	51	40	48.5	54	39	50
23	RAJA	57	43	48	57	43	53	53	42	47

24	INDHU CHOLAN	55	41	47	53	42	47	55	40	50
25	MAHENDRAN	55	40	50	54	39	50	53	42	47
26	KALAISELVAN	47	35	47	48	37	50.6	49	38	49
27	MUBARAKHAN	49	38	49	49	39	46.7	49	38	49
28	CHUTTIMA	53	42	47	53	41	50	52	41	50.2
29	NARAYANASAMY	54	39	50	53	42	47	51	40	48.5
30	SARASWATHY	47	35	47	48	37	50.6	49	38	49
31	DHARMALINGAM	55	41	47	53	42	47	52	38	51.6
32	MARIYAPPAN	55	40	50	53	41	50	53	42	47
33	ARJUNAN	57	43	48	53	42	47	53	41	50
34	RAMASAMY	54	39	50	53	39	55	53	39	55
35	SHAGUL HAMEED	49	38	49	50	39	49.2	50	37	50.2
36	SELVARAJ	53	41	50	55	41	47	50	39	49.2
37	KANAGARAJ	47	35	47	48	37	50.6	49	37	50.6
38	USHA	55	41	47	53	41	50	54	43	46.6
39	BABU	49	38	50	48	34	54.8	49	37	50.6
40	KANNAN	53	42	47	55	41	47	53	42	47
41	SENTHIL KUMAR	47	34	50	50	39	49	52	38	51.6
42	RAGHUNATHAN	50	39	49	50	38	52.2	49	38	49
43	RAMADOSS	57	43	48	55	41	49	57	43	48
44	GOVINDHAN	55	40	50	53	39	55	53	42	47
45	MANJAPPAN	49	38	49	50	39	49.2	53	41	50
46	VENKATESAN	53	41	50	55	42	51.7	51	40	48.5
47	ANNAMALAI	47	35	47	49	38	50	49	38	49
48	MARIMUTHU	47	36	46	49	38	49	49	37	50.6
49	MURUGESAN	54	39	50	51	38	47	50	39	49.2
50	CHINNASAMY	47	36	46	50	39	49.2	51	38	47
51	VENKATARAMAN	47	34	50	48	34	54.8	47	34	50
52	RENGANATHAN	49	38	49	47	34	50	49	38	49

53	SUKUMAR	55	41	49	55	42	51.7	53	42	47
54	MUTHU	50	39	49	49	38	50	49	37	50.6
55	PALANISMAY	53	42	47	55	42	51.7	51	40	48.5
56	SUDHAKAR	53	41	50	53	39	55	55	42	51.7
57	RAVISHANKAR	50	39	49	51	38	49	53	41	50
58	MASTHAN	47	34	50	48	34	54.8	49	37	50.6
59	KRISHNAMURHTY	55	41	47	53	41	50	50	39	49.2
60	AMMAM	53	41	50	55	42	51.7	51	40	48.5
61	KARUPPAIAH	49	38	49	50	39	49.2	50	37	50.2
62	DANIEL	47	35	47	47	34	50	47	36	52.7
63	SUNDAR SAMY	55	40	50	51	38	47	53	42	47
64	ANANDHAN	57	43	48	53	41	50	57	43	48
65	RAVIARASU	54	39	50	53	39	55	50	39	49
66	MANOHARAN	47	34	50	48	34	54.8	51	38	47
67	SATHISH	53	42	47	51	38	49	51	40	48.5
68	DOSS	50	39	49	50	38	52.2	50	37	50.2
69	SEKAR	51	38	47	50	39	49.2	51	38	47
70	VELUMANY	50	39	49	50	38	47	49	38	49
71	RAMESH	55	41	47	53	41	50	51	40	48.5
72	SURESH	47	35	47	49	38	49	47	36	52.7
73	GANESH	53	41	50	55	41	47	53	41	50
74	SETHU	49	38	49	50	39	49.2	50	37	50.2
75	RAGHU KUMAR	55	40	50	53	41	50	51	38	47
76	ADAIKALAM	57	43	48	53	41	50	53	41	50
77	SELVAM	47	34	50	49	38	50	49	38	50
78	BALAJI	53	42	47	53	41	50	51	40	48.5
79	MARIYAPPAN	53	42	47	51	38	47	48	38	49
80	RAMKUMAR	54	39	50	53	42	47	53	41	50
81	ADHIKESAVAN	47	35	47	48	36	48.8	49	38	49

82	SELVARAJ	53	41	50	53	42	47	50	37	50.2
83	RAMESH	49	38	49	50	39	49.2	49	38	49
84	IYYASAMY	55	41	47	54	41	47	51	40	48.5
85	VENKATASAMY	47	34	50	49	38	49	47	36	52.7
86	VARADHARAJAN	50	39	49	51	38	47	50	37	50.2
87	RAVI	47	34	50	48	34	54.8	47	36	52.7
88	RAJENDIRAN	53	42	47	53	41	50	51	38	47
89	SOLLAMUTHU	47	35	47	49	38	49	49	38	50
90	FAZULUDEEN	55	40	50	53	41	50	51	38	47
91	SUBBAN	55	41	47	50	39	49.2	47	34	50
92	PONNURANGAN	49	38	49	47	34	50	47	36	52.7
93	RAMAMOORTHY	53	41	50	55	41	47	53	42	47

EDD –End Diastolic Dimension

ESD - End Systolic Dimension

EF – Ejection Fraction

PTCA – Percutaneous Transluminal Coronary Angioplasty

Information to Participants

Title:
Assessment of Regional Myocardial Function Using Tissue Doppler Imaging Before and After PTCA of Left Anterior Descending Coronary Artery

Principal Investigator:
Co-Investigator (if any):

Name of Participant:

Site: RGGGH& MMC, Chennai

You are invited to take part in this research/ study/procedures/tests. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns.

What is the purpose of research?
We wanted to evaluate regional myocardial function using tissue Doppler imaging before and after PTCA of left anterior descending coronary artery

We have obtained permission from the Institutional Ethics Committee.

The study design
It is a prospective follow up study.

Study Procedures

- In patients with stable angina after myocardial infarction coronary angiogram was done. We select patients with single vessel disease involving left anterior descending coronary artery and study the changes in tissue Doppler imaging findings before and after coronary angioplasty.

The results of the research may provide benefits to the society in terms of advancement of medical knowledge and/or therapeutic benefit to future patients.

Confidentiality of the information obtained from you

You have the right to confidentiality regarding the privacy of your medical information (personal details, results of physical examinations, investigations, and your medical history). By signing this document, you will be allowing the research team investigators, other study personnel, sponsors, Institutional Ethics Committee

and any person or agency required by law like the Drug Controller General of India to view your data, if required.

The information from this study, if published in scientific journals or presented at scientific meetings,

Will not reveal your identity.

How will your decision to not participate in the study affect you?

Your decision not to participate in this research study will not affect your medical care or your relationship with the investigator or the institution. You will be taken care of and you will not loose any benefits to which you are entitled.

Can you decide to stop participating in the study once you start?

The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during the course of the study without giving any reasons. However, it is advisable that you talk to the research team prior to stopping the treatment/discontinuing of procedures etc.

Signature of Investigator Signature of Participant

date

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Assessment Of Regional Myocardial Function Using Tissue Doppler Imaging Before And After PTCA Of Left Anterior Descending Coronary Artery

பெயர் :	தேதி :
வயது :	புற நோயாளி எண் :
பால் :	ஆராய்ச்சி சேர்க்கை எண் :

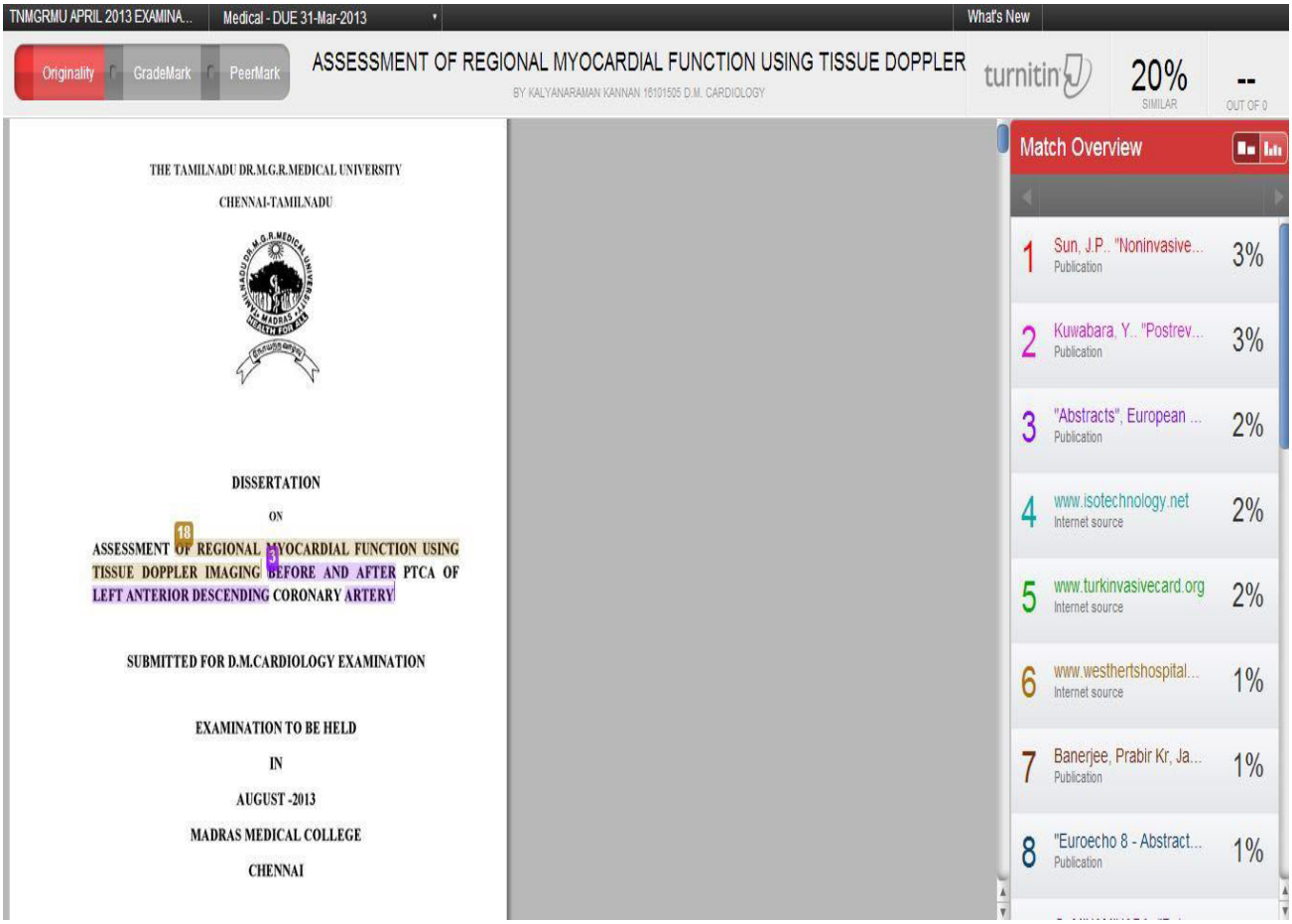
இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது. எனக்கு விளக்கப்பட்ட விவரங்களை புரிந்து கொண்டு நான் எனது சம்மதத்தைத் தெரிவிக்கிறேன்.

எனக்கு இந்த ஆராய்ச்சியில் பங்கேற்க சம்மதம். இந்த ஆராய்ச்சியில் பிறரின் நிர்பந்தமின்றி என் சொந்த விருப்பத்தின் பேரில் தான் பங்கு பெறுகிறேன் மற்றும் நான் இந்த ஆராய்ச்சியிலிருநடது எந்நேரமும் பின் வாங்கலாம் என்பதையும், அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் புரிந்து கொண்டேன். இந்த ஆராய்ச்சியின் விபரங்களைக் கொண்ட தகவல் தாளைப் பெற்றுக் கொண்டேன்.

இந்த ஆராய்ச்சியின் விவரங்களையும் அதன் நோக்கங்களையும் முழுமையாக புரிந்து கொண்டு எனது சுயநினைவுடன் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக் கொள்ள சம்மதிக்கிறேன்.

கையொப்பம்

PLAGIARISM CERTIFICATE



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Author	Kalyanaraman Kannan 16101505 D.M. Cardiology
E-mail	kalyanaraman.kannan@gmail.com
Submission time	15-Mar-2013 11:25PM
Total words	4340

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THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY CHENNAI-TAMILNADU DISSERTATION ON ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION USING TISSUE DOPPLER IMAGING BEFORE AND AFTER PTCA OF LEFT ANTERIOR DESCENDING CORONARY ARTERY SUBMITTED FOR D.M.CARDIOLOGY EXAMINATION EXAMINATION TO BE HELD IN AUGUST - 2013 MADRAS MEDICAL COLLEGE CHENNAI CERTIFICATE This is to certify that this dissertation entitled "ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION USING TISSUE DOPPLER IMAGING BEFORE AND AFTER PTCA OF LEFT ANTERIOR DESCENDING CORONARY ARTERY " is the bonafide record work done by Dr . K. KALYANARAMAN, submitted as partial fulfillment for the requirements of D.M.Post graduate Higher speciality courses branch II...

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. K. Kalyanaraman
PG in DM cardiology
Madras Medical College, Chennai -3

Dear Dr. K. Kalyanaraman

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " Assessment of regional myocardial function using tissue Doppler imaging before and after ptca of left anterior descending coronary artery " No.07032012.

The following members of Ethics Committee were present in the meeting held on 22.03.2012 conducted at Madras Medical College, Chennai -3.

1.	Prof. S.K. Rajan. MD	-- Chairperson
2	Prof. Pregna B. Dolia MD Vice Principal, Madras Medical College, Chennai -3 (Director , Institute of Biochemistry, MMC, Ch-3)	-- Member Secretary
3.	Prof. B. Kalaiselvi. MD Prof of Pharmacology ,MMC, Ch-3	-- Member
4.	Prof. C. Rajendiran, MD Director , Inst. Of Internal Medicine, MMC, Ch-3	-- Member
5.	Thiru. S. Govindsamy. BA BL	-- Lawyer
6.	Tmt. Arnold Soulina MA MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee